SCIENTIFIC AMERICAN

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THE OTIS ELEVATORS AT THE COLUMBIAN EXPOSITION.

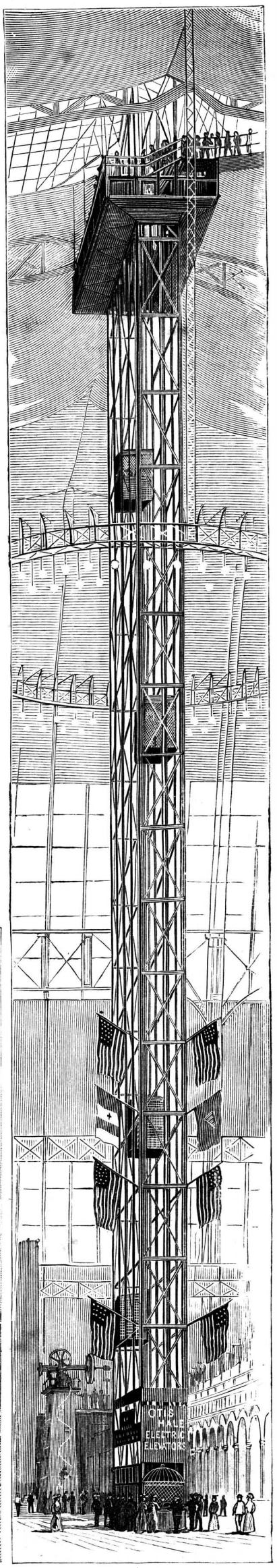
The display of elevators at the World's Columbian Exposition is very large and includes practically every type of elevator that is used. Probably a dozen different manufacturers make exhibits. The largest and most noticeable display is made by Otis Brothers & Company, of New York, who not only have a large and fine exhibit in the Transportation building, but also have many elevators in actual use throughout the Exposition. Three elevators are conspicuous features in the space occupied by the exhibit of this company, and these are in constant use, carrying passengers to the gallery and return. In the central tower of the Transportation building eight hydraulic passenger elevators have been installed. These were designed primarily to carry people to the roof promenade and restaurant, but after the burning of the cold storage plant the Exposition management closed the roof to the public, and since then only two elevators have been used, and these simply to carry people to the gallery. In the Administration building there are eight Otis electric passenger elevator engines. In the Manufactures and Liberal Arts building there are four electric elevators which carry people to the roof promenade, while in the Casino building there are two hydraulic passenger elevators, one hydraulic freight elevator, and two hydraulic direct-acting dumb elevators.

No elevators at the Exposition have attracted so much attention as those in the Manufactures and Liberal Arts building. These have the highest rise of any electric elevators in the world—a distance of 185 feet. The distance, however, seems much in excess of this because the tower in which they run is in the center of the north end of the main aisle of the building, and is open on all sides, as may be seen by examining the illustration on this page.

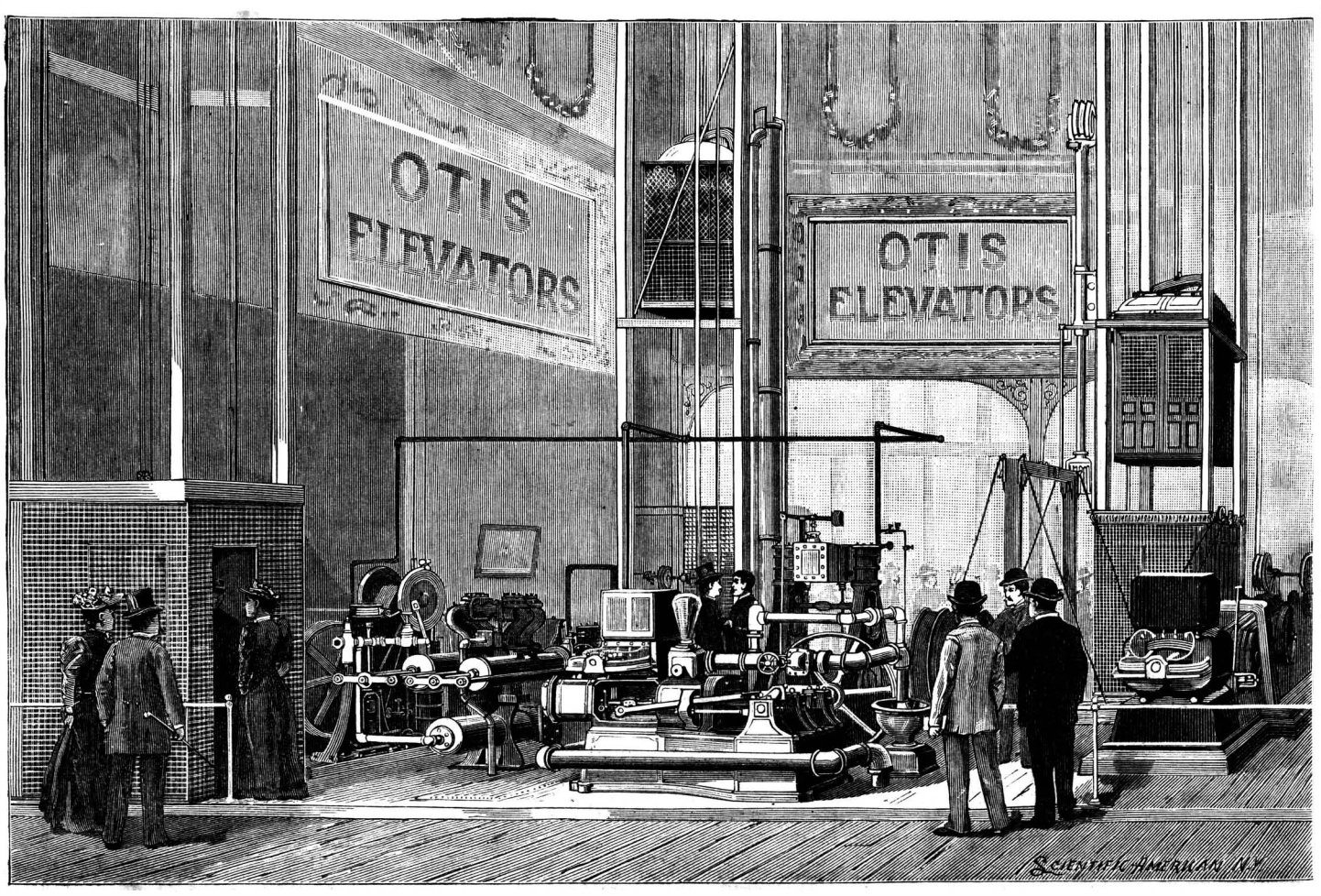
These elevators are operated by electricity, and represent the latest achievements in the manufacture and operation of elevators, both from a commercial point of view and from considerations of safety. There are four cars in this shaft, but they are run in pairs, so that in reality there are only two plants, which are attached to opposite sides of the drum, and which have no independent counterbalances, as the cars balance each other. Each car has a carrying capacity of fourteen people, and there is an attendant in each car, although the operating is done in one car for each set; that is, the wheel-operating device in one car controls not only the operation of that car, but also the one which counterbalances it. The cars are run at stated intervals and are started at a signal, at which the doors at the top and bottom are closed. The electric motor which operates each machine is of 15 horse power capacity and derives its current from the 500 volt Exposition power circuit. The speed of the elevators is 200 feet per minute. The machinery is installed in the basement of the building, immediately under the elevator shaft. The armature shaft of the motor is coupled direct to a worm shaft by insulating coupling. This shaft engages two gear wheels, which in turn engage each other. The worm shaft is double, being both right hand and left hand, so that there is no end thrust, this being taken up between the two wheels. The electric controlling device is a solenoid coil, which is in the main armature circuit, and which acts on a core rigidly attached to the rheostat brush, thus automatically controlling the amount of resistance in the armature circuit. The motor is of the Eickemeyer type. The armature makes 800 revolutions per minute and the speed is readily reduced by means of the worm shaft. The motor is compound wound and so arranged that when the operator throws on the current it uses both the shunt and series fields; but when the load is started the series field is automatically cut out, leaving the shunt field to control the speed. The brake device is of the iron strap pattern, faced with leather, applied automatically.

A great many electric elevators constructed on this same general plan, except so far as the counterbalance is concerned, have been installed by the Otis Company. The general plan for counterbalancing is that the weight of the car is almost counterbalanced by a weight attached directly to the car, while one-half the maximum load is counterbalanced by another weight attached to the opposite drum from the main hoisting cable; the result being that the motor is not called upon to work except to one-half of the rated capacity of the elevator. These elevators are provided with an automatic stop at the bottom, also at the top of travel. The application of electricity to elevator use has been very successful, as is shown by the efficiency of these elevators at the Exposition, and it has been in use long enough and has been tested thoroughly enough to prove its special advantages. It has advantages over steam on account of its economy under general conditions, smoothness of operation, and freedom from dust, noise and heat. Neither does it require the attention of an engineer or other skilled attendant. As compared to hydraulic elevators, the electric elevator does not occupy as much space, is cheaper in first cost, and in ordinary use is probably cheaper of operation, as it calls for only as much energy as is required to manage the load, while the hydraulic elevator uses so much water regardless of the weight of the load, and works to its fullest efficiency only when every load is a maximum one.

There are conditions, however, to which steam and hydraulic elevators are especially suited, and the latest achievements in the construction of these elevators can be seen in the exhibit of the Otis Company. The elevators in the tower of



THE GREAT OTIS ELEVATORS IN THE LIBERAL ARTS BUILDING.



THE WORLD'S COLUMBIAN EXPOSITION—EXHIBIT OF OTIS BROTHERS & COMPANY'S ELEVATORS.

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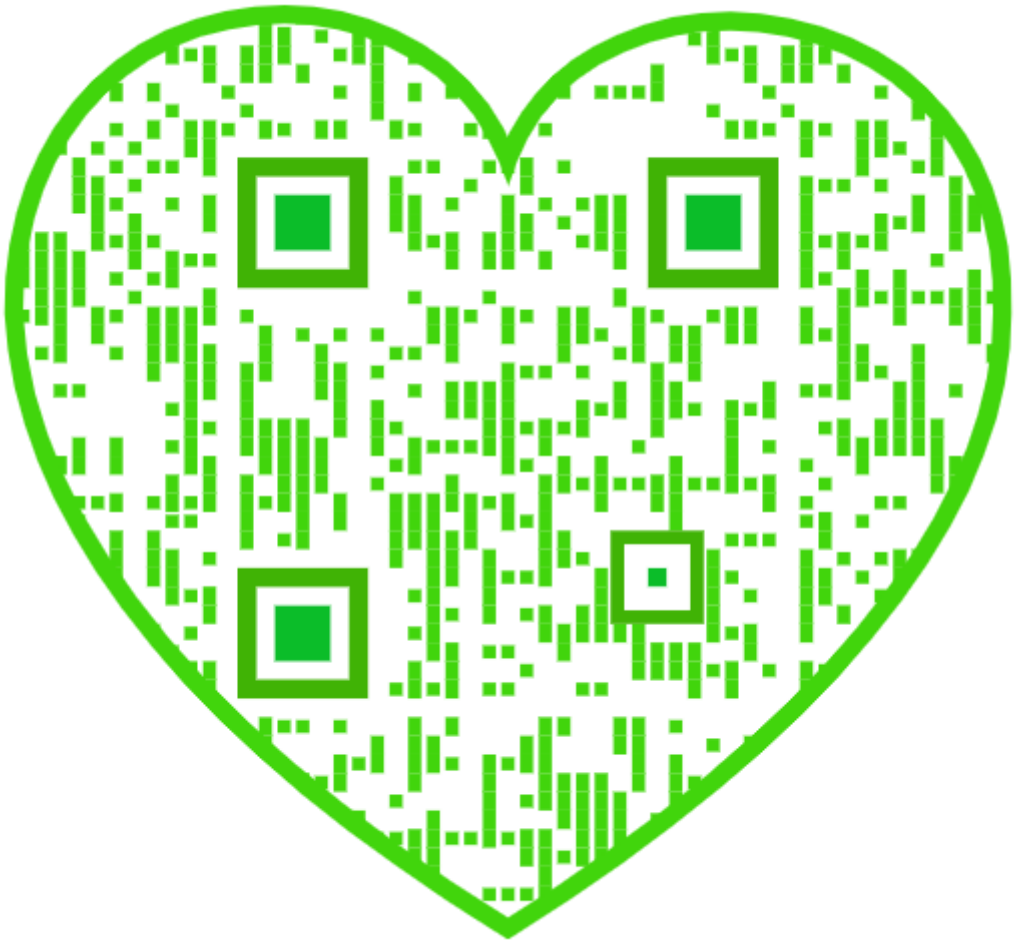

the Transportation building have two compound Worthington pumps, which pump water into 20,000 gallon pressure tanks. A hydraulic pressure of 90 pounds is used. The cars are supplied with all safety devices and with an automatic stop, so that they stop at the top and at the bottom independently of the operator without shock or jar. This is accomplished by means of a sleeve, which gradually closes the port as the main piston approaches the end of the cylinder, thus controlling the egress of water and bringing the car to rest gradually. Many of the cars exhibited have inclosing doors which are operated automatically by compressed air.

Steam elevators are used largely in factories and elsewhere where steam is to be had readily. The latest improvement in the construction of steam elevators, and which is shown in this exhibit, is the compound. This has great economy in operation, and the lowering of heavy loads is controlled without the use of the brake. These elevators, like all other Otis elevators, are supplied with safety devices, which stop the car and lock it firmly to the guides should any undue speed be attained from any cause whatsoever in descending. The elevator shown in the foreground of the picture of the exhibit is one of these compounds. The two shown in the rear of the space are electric, so that these in the exhibit space and those in the tower illustrate the three types of elevators manufactured by this company.

This company has installed several elevators which are of more than passing interest, as they show what a degree of perfection has been attained in this direction. The elevators in the Eiffel tower at Paris are of this company's make. At Weehawken, New Jersey, are three hydraulic elevators, each car having a capacity of 135 people or 20,000 pounds, and yet make a speed of 200 feet per minute. This is probably the largest elevator plant ever installed. The company is now installing a large plant in the tunnel under the harbor at Glasgow, Scotland, which has six lifting and six lowering elevators, each of a capacity of 12,000 pounds. This plant will work at a pressure of 800 pounds. Each of these elevators will be equipped with the so-called Thorpe valve. By use of this device a certain quantity of water is called for when the load is under 6,000 pounds, and a double quantity when the load exceeds 6,000 pounds. Another plant that the Otis Company has installed and which embodies many principles of the elevator is the inclined railway in the Catskill Mountains, which is 7,000 feet long, has a rise of 1,600 feet and carries 100 passengers with their baggage the entire distance in eight minutes.

Cooking by Gas.

Briefly enumerated, its advantages are:

It is always available at a fixed price; avoiding the necessity for the troublesome and tedious distribution of wood and coal, and saving the rent of a cellar and loss of money from market fluctuations.

Storage of fuel in the immediate neighborhood of the kitchen fire being unnecessary, the use of gas diminishes the risk of fire in a house.

The full heating power is developed from the moment of lighting a gas fire; thereby saving the time and labor spent on fire lighting, which in the case of liquid fuel is accompanied by danger, and accomplishing the work in the shortest possible time.

Increase or decrease of gas consumption according to the requirements of the moment; taking the place of the inevitable stirring of the fire, or removal of vessels from it.

The consumption can be controlled by the meter, so as not to exceed a certain limit ascertained to suffice for requirements.

It can be used with advantage in small as well as large apparatus; the consumption being exactly proportioned to the work to be done.

Scorching of food during cooking is completely provided against, since each burner can be turned down at any time, and the heat regulated to a nicety.

The radiant heat from a gas fire can be taken advantage of in winter for warming the kitchen, but in summer nearly wholly suppressed.

The retention of the full flavor of food is promoted by gas cooking, through the complete control of the application of heat.

No smoke is evolved from a gas fire, and damage to property, cost of cleaning, and all the inconveniences associated with the smoke nuisance, are avoided.

PERHAPS the meanest of all swindlers are those who prey on poor inventors. They look over the *Gazette*, issued by the Patent Office, every week, and get the names of those to whom patents have been newly granted. Then they write to each one, saying, "We see that you have got a good thing. We know certain parties who will put it on the market, supplying the necessary capital. Send $20 to cover the cost of negotiations." The inventor perhaps borrows the money and fowards it by mail. Subsequently he is informed that $15 more will be required, and in this way he is worked until nothing more can be got out of him.—*The Engineer.*

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HOW TO BECOME AN ELECTRICAL ENGINEER.

The SCIENTIFIC AMERICAN from time to time is asked by its correspondents for information on the subject of technical education. At the present time especially this question is asked with reference to electricity and electrical engineering. So much is being done in this field of work, and the importance of the subject is becoming so great, that young men are inevitably attracted toward it. The information sought from us frequently is the address of a school where electric engineering is taught, or what are the best steps for a young man to take to become an electrical engineer.

Sir William Thomson has stated that an educated mechanical engineer requires but a few months study to make of him an electrical engineer. It is fair to assume that the average young man contemplating electricity as a profession, if doing so with any justification whatever, from the force of circumstances must be a mechanic. If so he has taken the first step in the right direction.

The electrical station of the present day is based for its successful operation largely on economy in the generation and utilization of steam. The finest examples of the steam engineering in this country are supplied by them. The general engineering knowledge must not, therefore, stop with simple mechanics. The student must make up his mind to acquire the fullest possible knowledge of steam engineering and practice. It is not enough to know how to run an engine and boiler, he must understand the theory and construction of prime motors. When he feels that he is a thorough mechanic and thorough steam engineer, it will be time for him to think of completing his education by special attention to the electrical branches. While the theory of the science leads him to the higher mathematics, yet for practical work little more than elementary algebra is required. Our student must study the theory and mathematics of the subject from books. While doing this his practical studies should not be neglected. With his knowledge of mechanics he can construct dynamos, motors, and other objects in the engineering field, as well as galvanometers and instruments of precision. His last and graduating course will be an experience in the actual labors of an electrical station.

Reported Open Water Near the North Pole.

A vessel recently returned to San Francisco from carrying supplies to the whaling fleet in the Arctic Ocean, north of Alaska, reports that one whaler found open water at the mouth of the Mackenzie River, and had followed it in a northerly direction until he reached a point a little above eighty-four degrees, or farther north than the Greely expedition reached. It will be interesting to know whether this report can be verified when the master himself returns to San Francisco.

Four years out of five the ice packs in so heavily between Point Barrow and the mouth of the Mackenzie that it is impossible for vessels to penetrate it, but more frequently there is an open sea off into the northeast from Point Barrow. This direction, however, is regarded as a death trap by the whalers, and is religiously avoided. It is such a trap as De Long deliberately went into after being cautioned in the strongest terms by whaling masters not to be enticed into it. There have been seasons during the past twenty years when this northeastern ice entirely disappeared, and about ten years ago, one whaling master, who was determined to find whales, if any were to be found, took the risk and went in this direction some two or three hundred miles, as he estimated. Even then he did not reach any barrier. The water was free from ice, and from whales, too; hence he returned rather than risk going farther and stand the chance of the ice closing in on him from behind. But he reported finding considerable driftwood and seeing land birds. This led him to believe that land yet unknown and unexplored was not very far away. Since that time no whaler has explored in that direction until this one reported in the press dispatches. Hence it will be of importance to the scientific world to hear the full report of this voyage.

Scientific Training.

Professor Von Helmholtz, in a recent address to the students of Columbia College in this city, said that the recognized method of scientific work now was collection of knowledge, retention of that knowledge and its communication to mankind. There has been more accomplished by science during the last two centuries than during 2,000 years previously.

Careful observation makes the artist and makes the brilliant scientist. Trace the connection between events and the laws that govern that connection until doing so becomes intuitional. Train the mind so that the strongest impressions will be made by the most importantevents until this also becomes intuitional. Follow the advice of scientists of the last two centuries and go on by careful, accurate, complete observations to great discoveries and great successes.

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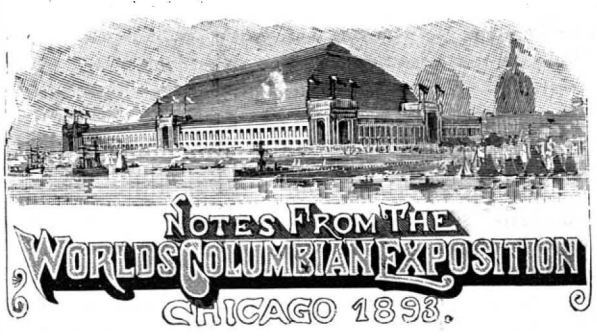

Many fine specimens of ivory tusks are to be found in the exhibit of the Brunswick-Balke-Collender Company. Some of these are quite straight while others are spiral and twisted. A pair from Zanzibar measure 8 feet 4 inches and 8 feet 5 inches respectively in length, and they are remarkably fine mates.

Grand Rapids, Mich., prides itself upon being a furniture center of the earth. There are at present sixty-two furniture factories in that city, and seventeen of them combined and made up a novel exhibit in the Manufactures and Liberal Arts building. This exhibit has been of great service to the American public, but more especially so to the foreigners at the Exposition, both because of the fine quality of the workmanship and the reasonable prices.

One of the most attractive sections of the space occupied by this exhibit is a corner fitted up as a sleeping room with five pieces, each made of bird's eye maple. The set is valued at $1,000, and is made up of contributions from four manufacturers. There is a good deal of hand carving on this and most of the other furniture, which attracted the admiration of the French workmen. The many pieces of furniture made of mahogany show that this wood retains its popularity. There are several elaborate folding beds of old San Domingo mahogany. One of these is elaborately trimmed with gold-plated brass ornaments, and comprises, besides a folding bed, a wardrobe, writing desk, chest of drawers, etc. It is valued at $2,500. One room fitted up as a dining room is furnished with a dining table and chairs to match, sideboard and side table of rich mahogany, all in colonial style. Another room is fitted up as a sleeping apartment with four elaborately carved mahogany pieces, which are valued at $1,400. Most of the furniture is designed on French lines, but is Americanized, as it has strength and solidity added to it, and there is a great variety of designs, as these factories change their styles twice every year —January and July. The furniture shown in this exhibit was taken from the stock manufactured during the period between January and July last. It is now, however, out of date, new patterns having superseded them.

The only comparatively cheap furniture is the furnishing of a sleeping apartment with a set of three pieces of curly birch. This wood is becoming very popular.

Guatemala gives an excellent idea in its building of the type of houses occupied by the wealthier classes in this and other republics at the South. In the interior court of the building is a fountain and a large display of orchids and other tropical plants. The exhibit is surprisingly large and varied, and is classified in different rooms under the heads of agricultural and natural products, geology, fauna, flora, liberal arts and manufactures. The display of birds and animals is excellent, and in the department of natural products coffee and cabinet woods are the most attractive features. Coffee is sold in a little pavilion adjoining this building, in order to make it popular in this country.

Colombia exhibits more aboriginal antiquities of both pottery and metal work than the other southern republic. There is also shown in the building of this government a collection of insects and brightly colored butterflies. The handiwork of the native Indians is well shown by many specimens of carved wood, wax figures, etc., illustrating traits in every-day life among these natives.

The exhibit made in the department of manufactures in the British section of the Palace of Manufactures and Liberal Arts is interesting. Nearly all the well known manufacturers of high grade china make displays that are not excelled, if equaled, by anything in their line at the Exposition. The display of Royal Worcester ware is very complete and comprises many beautiful vases, dining sets, lamps, etc. The largest piece of this ware ever made is a vase very graceful in design and richly ornamented, and valued at $6,000. The display of Cauldon china has attracted particular interest, particularly the set of a dozen plates called the "Evangeline" set, each plate having painted in its center a picture executed by Boullemier, representing an incident told in this poem of Longfellow's, so that the set practically recites the poem. The price of this set is $2,000. These plates have probably been sought out more than any other special work in the exhibit of china. The Shakespeare vase is another popular piece. It stands three feet high, and on the base are four figures representing "Comedy," "Tragedy," "History" and "Poetry." The vase is elaborately ornamented. There are eight panels, a Shakesperean heroine being painted on each panel. This painting is also the work of Boullemier. Still another work by the same artist is the Columbus vase. Doulton, Coalport, Minton, Wedgwood and other well known wares are also represented. A Lambeth vase most elaborately designed, six feet three inches high, is one of the striking pieces. This piece was purchased by the Gaekwar of Baroda. In the Wedgwood exhibit are many beautiful specimens of *pate surpate* ware and reproductions of the famous Jubilee vase presented to Queen Victoria in 1887.

There is a notable display of reproductions of Irish antique art metal work. Many of these pieces date back from a thousand to fifteen hundred years, and would be considered not only fine but decidedly artistic in the present day, with all the advantages that the progress of the intervening centuries have brought. Among the most interesting things of this display is the collection of gelts, which are the oldest weapons known in history next to stone weapons. These are made of an alloy of bronze. There is also a remarkable well made iron bell called the Bell of St. Patrick, which is believed to be the oldest relic of Christian iron workers.

In the division of household decorations the display of embossed and tapestry wall paper and other draperies is excellent, and as a combination of the various exhibits in this division, there is shown a reproduction of the Hatfield banqueting hall. This room is exceedingly rich in antique and carved oak, tapestries, and other old reproductions. In the section of floor coverings, several rugs are shown which represent an amount of handwork which is quite beyond the comprehension of an American. The choicest of these is a small rug which occupies a glass case by itself. This rug is made of silk and each square inch contains over two hundred stitches, each stitch being tied separately by hand. The entire rug represents 400,000 such stitches. It required twenty-eight miles of the finest silk thread to complete this work. Another fabric equally as incomprehensible in the amount of handwork it represents is the finest piece of linen ever made. It is most delicate fabric and contains six thousand threads in the width of thirty-six inches. But in the display of Irish lace is a piece of handwork much more delicate in appearance and which apparently required more skill in making than either this linen or the rug. This lace is made of the finest thread of two-ply Shetland wool. It is two yards and a half square, weighs two ounces and a quarter and contains about eleven thousand yards of the two-ply thread or twelve miles of single yarn.

The display of fine arms made by British manufacturers is a very popular resort to men and especially to Westerners. Well known makes of shot guns and rifles are exhibited, and there are models large and small showing the action of several makes of guns, also illustrating the working of some of the new hammerless guns, shell extractors, etc. In the Greener exhibit are the latest Martini-Henry rifles, also other rifles, including double barreled elephant rifles and the new regulation 0·303 repeating rifle. The size of the elephant rifles and the fact that they have such large bores and that they shoot shells is an endless source of comment. A still larger gun shown in this section is the Greener whaling gun. It has been used for many years in the British whaling service for shooting whales. Its limit of range is about six hundred yards.

A fish hook manufacturer displays in an adjoining exhibit a lot of hooks so fine in size and light in weight that 500,000 of them weigh only 22·77 ounces avoirdupois. In this exhibit there are also fish hooks of all sizes and for all uses as well as all kinds of flies. In this section wire is made into fish hooks and needles. The full operation of making the needle from the coil of wire to the finished article is shown, and is extremely interesting.

In a modest display of druggist supplies is shown the medicine chest that Stanley took with him on his last trip through Africa. It comprises a solidly built wooden box incased in an outer box of tin. There are forty bottles in the box, each bottle in the box being labeled. The various tabloids remain now just as they were when the case was brought home by the explorer, except that pieces of cotton are stuffed in each bottle to prevent the tabloids from being broken by any jar. Accompanying this box is a little covered pamphlet bearing the words "Traveler's Medical Guide, H. M. Stanley." On the inside to the cover of the box is a little case containing a full outfit of surgical instruments.

Of the exhibits made by the colonies of Great Britain in the Manufactures and Arts building, the most attractive and interesting is that of India. The gem of the exhibit is an India room constructed almost entirely of teak wood, elaborately carved. The interior is finished with the same completeness that the exterior is, so far as the carving is concerned, and the ceiling is laid off with panels, while the cornice is very heavy carving in teak. The furniture and draperies are also of oriental manufacture. Considerable teak carving is also shown in the other spaces occupied by India. The larger part of the exhibits however are of Benares ware, carved ivory and sandal wood, cutchwork in solid silver, Bombay Delhi, and Jaypore pottery.

In the Ceylon exhibit is a pagoda of octagonal design after the manner of Cingalese ecclesiastical architecture. The posts of this pagoda are of ebony, satin wood and jak wood, elaborately carved in oriental style. There is also an exhibit of native cutlery, metal work, basket work, etc.

The exhibit of cooking stoves in the German exhibit would bear close study and observation by American stove manufacturers, so far as appearance is concerned. Some of the American made stoves are very elaborate in the ornamenting in the iron casting and in nickel plated trimmings, but the German stoves are finer in effect, more artistic and more attractive by the use of tiles in place of iron.

The second week in October brought a most remarkable attendance at the Exposition. During seven days there were 2,121,794 paid admissions. This falls but a little short of the entire attendance of either the months of June or July, and is nearly one million more than the attendance during May.

The banquet tendered the representatives of all the foreign nations and states represented at the Exposition was held in Music Hall, October 11, and was the greatest social event since the Exposition opened. Covers were laid for 450 and the hall was profusely decorated with flags of all nations, while all national airs and other distinctive music was provided throughout the evening. The galleries of the hall were occupied by ladies. Thousands of palms, roses, and other decorative plants and flowers transformed the hall into a bower of verdure and color. This banquet was purely unofficial, although it was tendered the representatives by those who have been active in creating and managing the Exposition.

Homes and Remains of the Cliff Dwellers.

BY H. C. HOVEY.

A rugged mass of staff, building paper, and sheet iron stands near the Anthropological building at the World's Fair, painted in imitation of red sandstone, and with beetling ledges and strange surroundings. A sign tells us that this is the Cliff Dwellers' exhibit; and we learn, on inquiry, that it stands where it does with the approval of Prof. F. W. Putnam, chief the Department of Ethnology. The stucture is designed to represent a Colorado land-mark, known as "Battle Rock," but called "Spirit Rock" by the Utes and Navajoes. Here dwelt cliff men, whose singular habitations are found by thousands, though long tenantless, not only in Colorado, but also in Utah, Arizona, and New Mexico. According to Schwatka, similar abodes are still occupied in Mexico; but the more recent researches of Lommholtz show them to have belonged to a different and later style of architecture. Attempts have been made, with good success, to reproduce the cliff dwellings on a small scale, by Messrs. Jackson & Holmes, and casts are for sale by Mr. Ward, of Rochester.

It was reserved for Mr. H. Jay Smith, of Minneapolis, aided by the liberality of Mr. C. D. Hazard, of the same city, to develop the idea on a surprising scale and with much accuracy. On meeting Mr. Frank Cushing, the white Zuni chief, I asked his opinion of their cliff dwellers' exhibit. His emphatic reply was: "It is magnificent, both in conception and development; and its museum is unquestionably genuine and very representative." Probably there is no better judge of such matters than he. More than one hundred thousand persons have visited this quaint exhibit; some of them men of science, but mostly people from the common walks of life, who probably took their first lessons in anthropology and archæology from the intelligent and obliging guides.

The structure now described is 200 feet long and 65 feet high. In inclosures around it are kept domesticated wahpiti, deer, mountain sheep, and other animals peculiar to the region. Precipitous trails wind over the hill, and at all hours of the day may be seen people climbing afoot or riding on the sure-footed burros kept for service. In the crevices of the quasi rocks cacti, sage brush and yucca plants maintain a struggle for existence. On each side of the entrance are ruins of estufas, through one of which we are admitted on paying the small sum requisite for maintaining the exhibit. What an abrupt transition from the brilliant displays of modern art and manufacture to these ancient forms of human life.

At the head of the canyon stands the Cliff Palace, reproduced on a scale of one-tenth the actual size. The model is 43 feet long; hence we infer the original to be 430 feet in length. The village (for such it is, rather than a palace) contains on the ground floor 127 rooms; but it is thought that there must have once been as many as 600 in all the stories. Some of these are round and others square, and they are of various sizes. Some were doubtless temples, others watch towers and others granaries. But most of them were

(*Continued on page 279.*)

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THE TEACHING OF SWIMMING.

All those who occupy themselves with natation know how difficult it is, at least for certain persons, to learn how to swim. This may appear somewhat strange when we know that the human body is sustained naturally in water. It is the slightly too elevated position of the center of gravity that obliges man to make certain motions in order to keep his head in the air and also in order to move forward in the liquid element. At all events, the exertion to be made must be very feeble, and the motions to be effected are very simple. They must especially be regular and be executed without precipitation. They can therefore be learned by every one without distinction. But many people cannot succeed in ridding themselves of a sort of instinctive fear, which, as soon as they are in the water, makes them lose their heads, so to speak, and causes them to make irregular and precipitate motions. They immediately get fatigued and cannot succeed in keeping their heads above water. Struck by this fact, teachers of swimming have endeavored to make the pupil repeat in the air the motions that he must effect in water, thinking that such exercises might prove of some utility. Formerly, for example, the pupils were made to execute, standing, the motions of natation, in moving the left limbs and then the right ones simultaneously. Later, the idea occurred to teachers to make the limbs effect the general motions in a horizontal position, always with the idea of more closely approaching the conditions of natation in water. There was then used a bench or wooden horse, upon which lay the pupil, who did his best to simulate the motions of extension and flexion that he would have to make in water. But the position upon the apparatus is very fatiguing. The chest is oppressed, respiration is interfered with and the exercises cannot last beyond two minutes. The elbows and knees touch the horse and the simulated motions are necessarily incomplete. Moreover, there is nothing to guide the pupil in the execution of the motions, unless he applies close attention and much willingness thereto.

All such inconveniences would be of slight importance were the practice of these theoretical exercises to lead the pupil to sustain himself easily upon water; but such is not the case, and many persons, despite the repetition of preliminary exercises, and despite their most ardent desires, cannot succeed in learning how to swim. The reason of such want of success is easy to understand: It is that there is nothing comparable between the motions that the pupil makes in the air and those that he makes in the water. Upon the horse, for example, his head and his limbs are unsupported. He finds himself in nowise in the condition in which he is in a mass of liquid, wherein, according to the principle of Archimedes, the entire body is sustained by the surrounding liquid, and wherein, on another hand, the limbs, in order to force back the water, have a harder work to perform than in the air.

Again, efforts have been made to teach a child how to swim by supporting him in the water and causing him to effect the motions of natation. This is the most practical process. Its inconvenience is that it necessitates the presence of a teacher with each pupil, and, in a large class of children, the teacher cannot occupy himself with each of them for a very long time. When the execution of the motions made by the pupil begins to be perfect, it is not yet finished. The efforts that the supported child has to make are relatively very feeble, and when he is placed all alone upon his own resources, without auxiliary aid, he finds himself a little disconcerted, and, provided instinctive fear seizes him, he will become paralyzed in his efforts, and will succeed with great difficulty in being able to swim alone.

Mr. Devot has been able to overcome all the difficulties of the preceding method in a very ingenious manner. His apparatus permits the pupil to learn to make the theoretic motions of natation perfectly in conditions entirely identical with those that present themselves when he tries to sustain himself alone in the water. The apparatus consists of two parts. One is fixed and serves to sustain the head and chest. The other is movable and serves to guide the limbs in the accomplishment of their motions. The fixed part is formed of a chest support, A, inclined toward the rear and provided with three legs. This support presents an appendix which carries a chin support, B, upon which the chin of the pupil rests. The body of the pupil upon the apparatus is in the very position that the body of a swimmer occupies naturally in water. The movable part is the really interesting feature of the apparatus. The direction of the motion of the arms is effected through the aid of two rubber straps fixed at one end to the chin support and terminating in wooden knobs serving as a support for the hands. The direction of the motion of the legs is obtained by the aid of rubber cords. To this effect, the hind legs of the fixed part are provided with horizontal crosspieces, CC, movable around a joint. The crosspieces carry uprights, DD, terminating at the upper part in two forks that carry a piece, E, movable around a horizontal axis, and which is designed to receive the thigh, whose movements it is capable of following. The uprights, moreover, are movable upon the crosspieces, where they may be fixed by pressure. The apparatus

tions are easy. His respiration is always free, and he can easily remain upon the apparatus for fifteen minutes. He can, therefore, repeat the motions a great number of times and become accustomed to them. As well known, when we become accustomed to repeat a motion, always accomplished under the same conditions, we do so in spite of ourselves. It becomes natural and fatigueless through practice.

The child, therefore, gets into the habit of making the same regular motions upon the apparatus that he has to make in water, owing to the rubber straps that serve him as guides and that have at the same time the happy effect of making him find the same resistance and the same bearing points as in water. The length of these straps is so calculated as to oblige the most awkward person to make, after a manner, perfect motions automatically, without his having to attend to anything else than the giving of the initial propulsion. The rubber rods force, conduct, and direct the motions begun in an exact and sure manner. The pupils learn the elements of swimming in a very short time, despite themselves, without attention and without effort. This is the great merit of the invention; so we cannot praise the inventor too much for the admirable patience that he has shown in perfecting, piece by piece, all the different parts of his apparatus, which, at present, may be considered as nearly perfect. It realizes a great progress in the teaching of natation that it would be unjust not to recognize. When the instruction of the pupil upon the apparatus is complete it is finished. Despite the paradoxical appearance of the fact, the pupil knows how to swim. When he enters the water he is no longer bewildered. He instinctively makes the same motions to which he is habituated. He at once feels himself sustained in the water, gains confidence, and has no longer anything to do but perfect himself progressively by practice. The result is certain and very rapidly obtained.

The preceding considerations are not solely theoretic conditions. They are supported by experience, and it is thence that they take all their value. The apparatus is in use among the pupils of the Michelet Lyceum, who have been the first to benefit by the invention of their master, Mr. Devot, who has received the unanimous felicitations of all those who have been witnesses of the great advantage that his new apparatus presents and of the facility with which his pupils learn the principles of natation, formerly so difficult—for certain persons at least. Thanks to it, now, there will be no more deception. All persons using the apparatus will quickly learn how to swim.—*La Nature.*

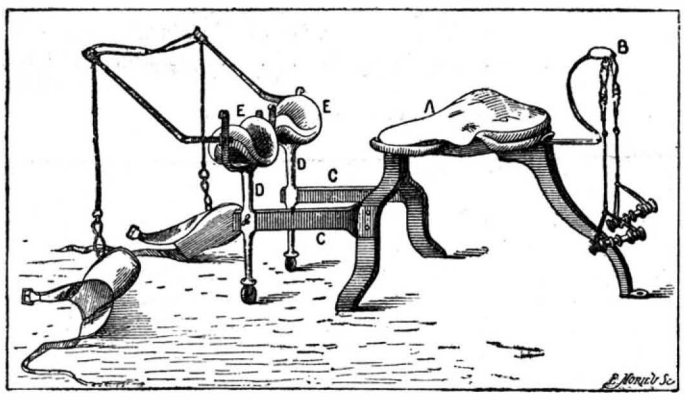
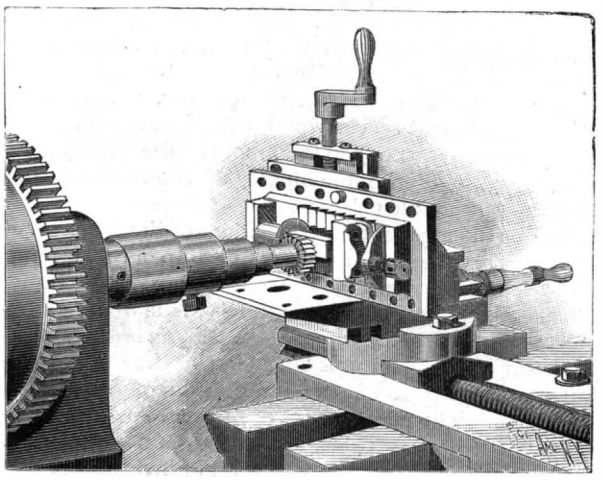


Fig. 2.—DETAILS OF SWIMMING APPARATUS.

A, chest support; B, chin rest; E E, support for the thighs; D D, uprights; C C, horizontal crosspieces.

A LATHE SLIDE REST ATTACHMENT.

The illustration represents a recently patented improvement of Count Strickland, of Villa Bologna, in



STRICKLAND'S LATHE SLIDE REST.

the island of Malta. It consists of a simply constructed attachment to the slide rest of an ordinary lathe, whereby the work may be moved vertically as well as longitudinally and horizontally in front of the milling tools or cutters held on the spindle of the lathe. On the ordinary slide rest, horizontal and longitudinal slides are usually secured, and the attachment is bolted on the front end of the upper one of these slides by a bracket in which is held a vertical slide. Projecting from the latter are work clamping dogs, on the vertical slide or on a horizontal shelf, on which dogs are vises or division plates for gear cutting, to which the work may be conveniently secured, so that it can be moved to or from the cutter in a vertical plane, its longitudinal and transverse movement being effected by the other slides. The device is of very simple and inexpensive construction.

Electro-chemical Effects on Magnetizing Iron.

In the proceedings of the Royal Society, Mr. T. Andrews calls attention to the electro-chemical effects on magnetizing iron. From a long finely polished rod two steel bars were cut adjacently, so that they were practically alike in general composition and structure. These bars were both weighed, and then immersed in equal quantities of cupric chloride solution, one of them having previously been magnetized. After a certain time (6 to 24 hours) they were taken out of the solution, freed from deposited copper and carbonaceous matter, then dried, and again weighed. It was found in every case that the magnetized bar had lost more in weight than the unmagnetized bar. For instance, an average of 29 experiments showed an increase of corrosion in the steel due to magnetic influence of about 3 per cent under the conditions of experiment. It may be mentioned that the bars were not highly magnetized.

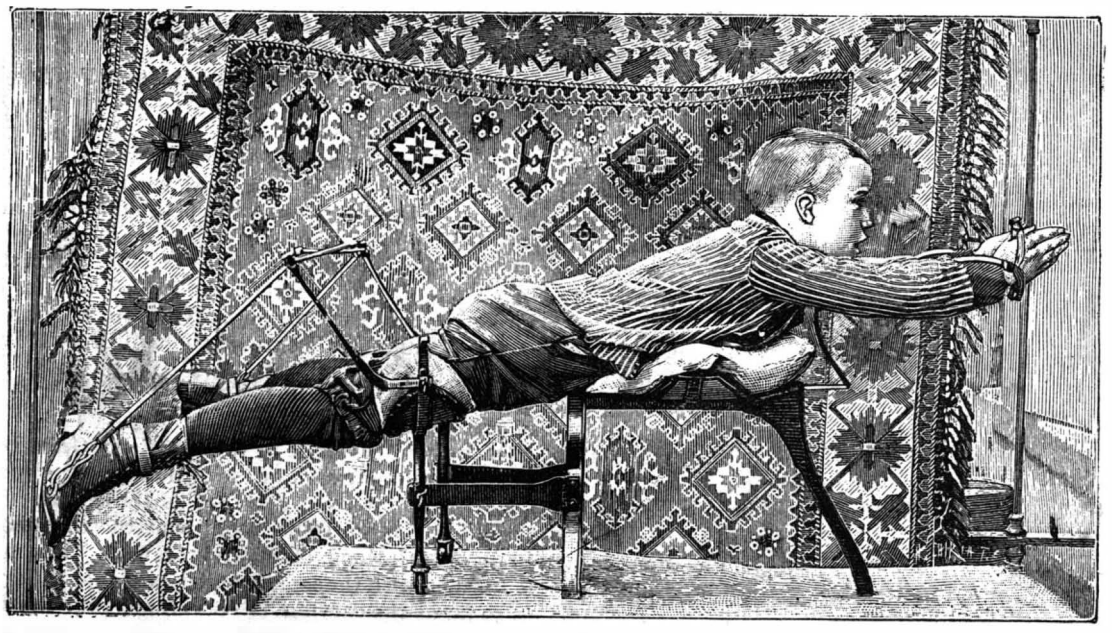


Fig. 1.—APPARATUS FOR TEACHING SWIMMING.

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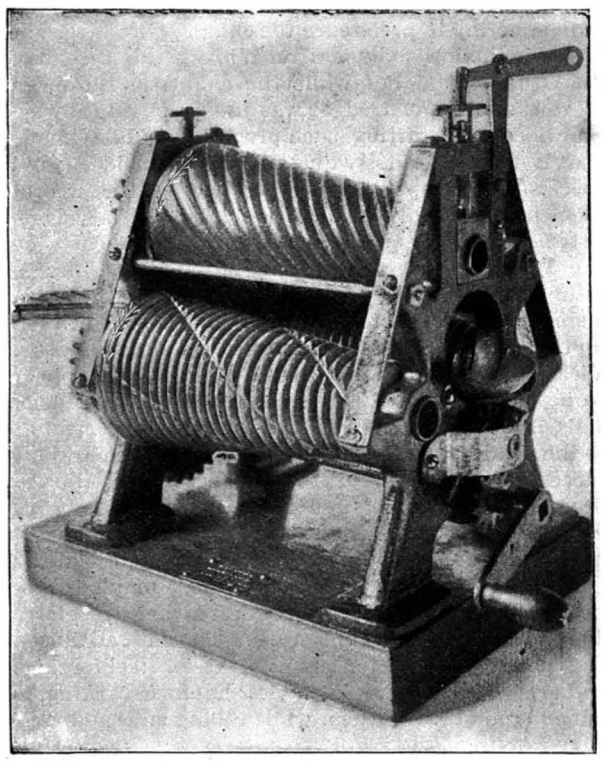
SUCKOW'S MACHINE FOR SQUEEZING PUDDLERS' BALLS AND THE MANNESMANN SEAMLESS TUBE MACHINE.

To the Editor of the Scientific American:

Strange it is but nevertheless true that humble original inventors in about *one* instance out of a hundred receive any credit or just compensation for years of their unproductive toil while alive, although they may witness in their declining years, with reduced strength and infirmities, the very invention at first sneered at brought forward and imitated successfully by



SUCKOW'S METAL SQUEEZING MACHINE.

other parties, of course under another name or names, without any redress, further than possible eulogy after their death. Numerous instances have appeared in your publications and elsewhere from time to time verifying this assertion, among them J. Crompton, the Englishman, originator of the spinning jenny; B. Thimonnier, the Frenchman, originator of the sewing machine; J. Ressel, originator of the screw propeller, etc., all of whom died poor and neglected. I inclose a photograph of the original working model of a machine of my invention, and one of which was purloined from me in 1882 on pretense of introduction after explaining further scope of the invention. I called it a "squeezer," and the invention with process you published with drawings and specifications complete, excepting the eleven claims, in the SCIENTIFIC AMERICAN SUPPLEMENT, June 30, 1877. In your issue of September 27, 1890, you also published and illustrated the so-called Mannesmann process for making seamless tubes from solid blocks of metal, with the portraits of the so-called inventors, as copied from *Uber Land und Meer*. Please compare my specification with the Mannesmann process. As an American, I feel anxious to know if this technical wonder, as some papers call it, and which now plays such an important part in the iron and steel industries, is in practical operation here, and if not, why not? And why do the Mannesmanns entirely ignore a civil communication in their own native language, forwarded to them a year ago? Further comment I don't deem necessary. ED. SUCKOW.

Jamestown, N. Y., October 10, 1893.

[A comparison of the Suckow with the Mannesmann machine certainly seems to indicate that the earlier American inventor came very near to the result by which fame and fortune were subsequently realized by the German inventors. Although the earlier patent was primarily for different purposes, and the machine was incapable without change of making the Mannesmann products, the earlier Suckow machine so strongly suggests the principal idea of the Mannesmann as in itself to afford a most probable answer to the question of our correspondent. Inventors who have become practically and financially successful do not look around for others who possibly anticipated them in their ideas but neglected or failed to improve their opportunities.—ED.]

FOR sticking glass labels on drawers, the best cement to use is a thick solution of shellac in benzole, in which gutta percha in the proportion of 1 in 12 has been dissolved.

Microbes on Post Cards.

The latest scare in microbes has been started by Professor Uffelman, of Rostock, who infected a letter with cholera bacilli and put it into a post bag. When the letter was taken out, 23¼ hours later, the bacilli were still alive. Bacilli were also found living on post cards twenty hours after infection. The micro-organisms were found to die rapidly when placed upon coins. A fly charged with cholera bacilli was afterward placed on some beef. A little later the meat was found to be swarming with bacteria. A finger was infected with cholera bacilli and dried. One hour later the finger was rubbed on some roast meat, and numerous bacilli developed subsequently. The moral of all these experiments is obvious.

PIANOS AND ORGANS AT THE FAIR.

Among the many exhibits of pianos and organs in the Manufactures and Liberal Arts building at the World's Fair, Chicago, there is none perhaps which at once attracts attention and holds the same more than that of the Mason & Hamlin Organ and Piano Company. The exhibit occupies a fine position just at the right of the main entrance to the musical section of the Liberal Arts building on the south side, and includes about twenty instruments in all. Here may be seen grand and upright pianos, the celebrated Liszt organs, and many styles of smaller organs. The *piece de resistance* is a two manual pedal base Liszt organ, with a highly decorated pipe top. This instrument is sold largely for churches, convents and lodges throughout the country. Although a reed organ, it is built on the plan of a pipe organ, the stops running throughout the registers. There is a full set of foot pedals, and altogether it is a most complete instrument. There is one of these instruments, also, in the Art Palace at Chicago. An interesting organ also is the India model, which is inclosed in a case of cedar, and in which there is no glue, the parts being riveted, so as to withstand the effects of the great heat and of dry climates.

Perhaps the most interesting feature of the exhibit is the piano plate, showing the now celebrated improved method of piano stringing invented and patented by Mason & Hamlin in 1882, and used exclusively by that company ever since. The strings of the piano by this system are held much more securely than in the piano as ordinarily constructed, and as a result the piano remains in tune much longer and is far more durable than in pianos in general. Among the upright pianos is one in dark mahogany, with Ionic upper pillars and the base in colonial style; another is in white and gold, with finely handpainted panels, finished by what is called the Daws enamel process, in Louis XIV. style. One of the handsomest uprights is the one in mahogany, with delicate handpainted satin wood panels. This is in marquetry style. There is a parlor grand in mahogany and the usual concert grand in its finest style. The parlor grand has hand carvings on antes and legs.

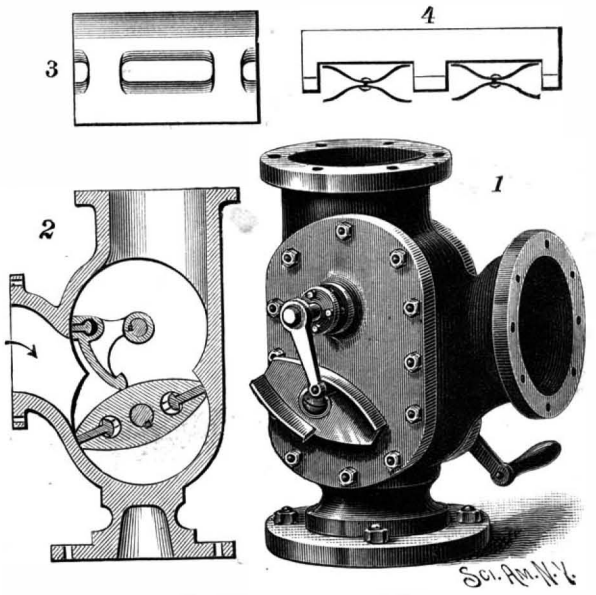
The little baby organ, which sells for $27, stands in the front, and as one man expresses it, is "perfectly able to speak for itself." The workmanship throughout the entire Mason & Hamlin exhibit is of the first grade.

Mason & Hamlin have received highest awards at the Exposition on both pianos and organs; their patented and improved method of stringing received especial mention, it being declared by the judges that by virtue of their device the Mason & Hamlin pianos remain in tune much longer than other pianos.

THE WORLD'S COLUMBIAN EXPOSITION—EXHIBIT OF THE MASON & HAMLIN COMPANY.

A DURABLE AND EFFICIENT PUMP.

The pump shown in the illustration is of comparatively inexpensive construction, and is designed to pump rapidly and work easily. It has been patented by Mr. Luigi Nasi, of No. 317 Bush Street, San Francisco, Cal. Fig. 1 represents a perspective view and Fig. 2 a vertical section, Fig. 3 a plan of the pump valve, and Fig. 4 one of the packing slides in the piston and valve. The inlet is at the side and the outlet at the top of the casing, and the driving shaft extends centrally through the lower of its two cylindrical chambers, the shaft having a hand driving crank, or a pulley for connection with other source of power. The piston is preferably ellipsoidal, as shown, although other forms may be employed, and at its ends are longitudinal slots which receive the packing slides. Centrally in the upper chamber is a shaft carrying a valve which extends forward toward the inlet, a curved wing of the valve, with thickened lower end, riding upon the piston. The main end portion of the valve is slotted and bored in the same way as the piston ends, to carry a similar packing slide. On the outer end of the shaft carrying the valve a crank with a handle may be used to start the pump when the water is first introduced; or the shaft may have at one end a crank carrying at its free end an inwardly extending stud to engage flanges on opposite sides and ends of



NASI'S ROTARY PUMP.

an ellipsoidal cam, shaped like the piston, and rigidly secured upon the piston shaft. In the latter case, when the piston strikes the valve wing and raises the valve, the flanges of the cam engage the stud of the crank and continue the movement of the valve. After the pump is started the crank may be removed and reliance placed on the back water pressure to hold the valve down in close contact with the piston, as after the pump is once filled it will work continuously without the valve-actuating mechanism.

Whistling Fireworks.

One of the features at the Crystal Palace (London) fireworks display recently was whistling pieces, which in burning give a wild, screaming noise. There is some mystery about how this noise is produced. Messrs. Brock themselves are unable to say, and do not know anybody who can tell them. The firework consists of a stout paper tube 2½ inches in length, and with a bore of about ⅜ inch. About 2 inches of this little tube are stuffed with picrate of potash, leaving ½ inch or so empty. When lighted by means of a fuse it does not explode, but burns away with great violence, and with the uncanny shriek which gives the thing its interest. Pyrotechnists have tried many other compositions and many other kinds and forms of tubes, but picrate of potash is the only thing that will give anything but the faintest trace of a whistle.

Pure Iron.

Professor Arnold, of the Sheffield Technical School, recently produced, with the aid of aluminum, a sound ingot and bar containing 99·81 per cent of pure iron. So far, no absolutely carbonless iron has been obtained commercially. An analysis of Professor Arnold's bar by Mr. R. A. Hadfield showed the following composition: Carbon, 0·07 per cent; silicon, 0·04 per cent; sulphur, 0·03 per cent; phosphorus, 0·015 per cent; iron, 99·81 per cent; total, 100·035 per cent. Its specific gravity was 7·863; limit of elasticity, 18 tons per square inch; breaking load, 23 tons per square inch; elongation, measured on 2 inches, 49·25 per cent; reduction of area, 69·60 per cent; fracture, silky

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Cold Forged Screws at the World's Fair.

The American Screw Company, of Providence, R. I., has three interesting exhibits at the World's Fair—in Machinery Hall annex, in Manufactures building, and in the Government building. The exhibit in Machinery Hall illustrates the new cold forging process employed in the manufacture of wood screws, drive screws, tire bolts, and any other kind of circular screw. This process was described and partially illustrated in the SCIENTIFIC AMERICAN, September 17, 1892. Two machines are shown in operation in this exhibit, the three-blow header and the threader, these being the only machines needed in this process. The wire used by this company is drawn with unusual accuracy, to the thousandth of an inch, even for large sized screws. The cold forged screw wastes no metal, except a very small quantity which is cut off the point of the screw blank. Wire is used three sizes smaller than the gauge of the finished screw. The three-blow header tapers the shank, forms the head, forges the slot in the head, points the blank, and cuts it off. The blanks are then taken to the threader, poured in the hopper, where, by an ingenious arrangement, they are placed in a row heads up, in an inclined runway leading between two dies, which shape the threads. These dies move horizontally in reverse action to each other and form the screw, raising the thread higher than the shank. One forward motion of the dies completes the screw, and the dies return idle. The screw is not cut at any stage and is much stronger than the ordinary cut screw, while by this process they are made much more rapidly. In a show case are exhibited four large screws, showing the form of the product at different stages of the development of the screw industry during the past fifty years, the cold forged screw easily carrying off the honors in the comparison by reason of its fine and very symmetrical appearance.

The exhibit in the Government building consists of nineteen models of screw machinery, from the oldest to the newest designs, covering cutting, heading, slotting, threading and cold forging. These models were loaned to the government by the American Screw Company. The history of the machines of which these models are shown is very interesting. The first inventor of prominence in the production of automatic screw machinery was Gen. Thomas W. Harvey, who devised a machine for shaping the heads of screw blanks. Gen. Harvey was followed by Cullen Whipple, Thomas J. Sloan, Charles D. Rogers, and others, and examples of their inventions may be found in this exhibit, also the machinery invented by the last named for cold forging. The screw machinery used in Enrope has been mainly of the Harvey and Sloan cutting type, cold forging machinery not being extensively employed there. The American Screw Company was formed by the union of the Eagle Screw Company and the New England Screw Company, both of Providence, R. I., in 1860, the Eagle Company having commenced operations in 1838, under the management of the late William G. Angell. In this country, at the present time, fifteen concerns manufacture wood screws and nearly one hundred different firms have undertaken this business since 1810.

The exhibit in the Manufactures building consists of two large upright cases, one of which contains a specimen of every kind of screw made by the company's cutting process and the other specimens of the cold forged product. Among the cold forged screws are the company's new fluted tire bolt and Rogers drive screws. The tire bolt has flutings on the shank, which hold it in place in the wood, and thus prevent it from slipping or working round and becoming loose. The flutings being straight, the bolt is easily driven out. The head of the bolt is materially strengthened by having the fluting terminate some distance from the head, leaving a plain shank. The Rogers drive screw has a thread with wide spirals, so that it can be easily driven with a hammer all the way, and the slot in the head does not extend entirely across the head, but has a shoulder on each side, so that it is not weakened by the hammer, while the slot is left perfect for the use of a screw-driver in withdrawing the screw.

Samples of these and other cold forged products are distributed by the company, as well as an illustrated circular, showing the different productions of the company. These samples will be forwarded on application, and all interested should address the company at Providence, R. I.

The New India Rubber Tree in Madagascar.

The *Journal des Mines* states that the trade of the island of Madagascar in 1892 received a decided stimulus by the discovery of a new India rubber tree. The principal centers where this new product is treated are Farafangana, Vaugaindrano, Manaimbondro, Fort Dauphin, Andrahomby, and Cape St. Mary.

At first the new product realized from 3 to 6 piastres per 100 lb.; aided by competition, the purchase price very soon amounted to 10 and then to 15 piastres. More than 20 piastres per 100 lb. is now paid at Fort Dauphin.

The discovery of the new India rubber tree has come very fortunately to relieve the Madagascar market, which was at such a low ebb that the Tamatave houses were closing their agencies on the northeast coast and the Americans suppressed their Majunga houses.

This discovery is of very great importance; it almost constitutes a commercial revolution. The trade formerly carried on between Farafangana and Fort Dauphin was confined to a few products which were obtained only in small quantities. Merchants were almost completely disheartened and had abandoned the market to small traders.

Several of the latter possessed but a few hundred piastres at the end of from 15 to 20 years of hard work. At the present day they are all relatively rich, and it has only taken them a year to gain their thousands of piastres. At the time of the India rubber fever new houses were immediately established at Farafangana, Yangaindra, Manaimbondro, Andrahomby, Fort Dauphin, and also at Cape St. Mary, bringing goods and money.

The natives, receiving large sums in return for their products, took upon themselves to purchase imported goods to a very large extent. As long as the working of the new rubber tree lasts, this state of things will continue. The probable duration of this working is estimated at two years only.

An English View of United States Warships and War Material.

An interesting article is given in a recent number of the *Engineer*, London, from which we make abstracts as follows:

After the close of the American war a long period might be expected to elapse before money would be voted freely for any purpose of war. Hence it followed that for about a quarter of a century the United States very properly rested, to an extent that would have been dangerous for any other nation, except, perhaps, Russia. At length came the time of awakening, which resulted in the masterly steps that have been taken during the last few years, both in the matter of ships and ordnance.

To begin with ships. Accepting the conclusions that had been arrived at by those powers who had been forced to push on continually, the United States authorities at once adopted types possessing the general features of such vessels as were most approved; for example, our Royal Sovereign class—that is, the 1889 design. Profiting by drawings giving all the necessary details, and even employing men who had been engaged in England in working out the designs, it was found feasible to spring, without a single false step or disappointment, to the very front, and to work forward so as to rival those who had offices and dockyards full of all that hardly-bought experience had furnished. We say it was feasible, but we do not say that it was by any means easy to command success in the striking way in which it has been achieved. The United States authorities are, then, to be congratulated—first, on the judgment that chose the line to be taken; and next, on the constructive ability and energy that was displayed exactly in the most profitable way. It naturally follows from what we have said, that any one would search in vain in the American fleet for such types as were developed in the twenty years following the close of the war in 1865. No mastless Thunderer or Dreadnought, no Inflexible or Italia, no masted Monarch or Duperre is to be found in the United States navy. In one tremendous stride, the United States constructors pass with hardly an intermediate step from the small coast defense Manhattan, with her 2,100 tons displacement and 19 ton smooth bore guns, to the modern ship with the powerful quick-fire armament and steel armor.

Any one taking up, say "Brassey's Annual" or "Lloyd's Register," will be struck, perhaps even considerably perplexed, by the fact that for a given displacement, America appears to have secured startling advantages compared with the European navies.

We will give a comparison between two cruisers. The English Blake of 9,000 tons was launched in 1890, and may be compared with the United States New York of 8,150 tons, launched in 1891, apparently to the great disadvantage of the former. The Blake has no side armor, being only "protected;" the New York has a 4 inch steel belt and 10 inches of armor on her turrets. The Blake carries two 22 ton 9·2 inch guns and ten 5 ton 6 inch guns; the New York, six 8 inch guns. The Blake has sixteen 3 pounder quick-fire guns, as compared with twelve 4 inch, eight 6 pounder, and four 1 pounder quick-fire guns as the secondary armament of the New York. Here, then, the superiority in the primary armament of the Blake is more than overbalanced by the New York's tremendous power quick-fire, as compared with the 3 pounder quick-fire guns of the Blake. Then, the Blake's speed is only given as 19·12 knots, while that of the New York is 20 knots. The Blake, it is true, is shown as having greater coal capacity, enabling her to steam at 10 knots for 15,000 miles, against the 13,500 shown for the New York. Nevertheless, to all appearances the American ship beats the English one hollow.

The character of the American warships may be briefly described as follows: They have been based on the best and most advanced models, they have been skillfully adapted to possess enormous powers of both attack and defense.

To the subjects of armor and guns, we find the same principles applied and with the same ability. The policy recommended by the board of officers who visited Europe in order to arrive at the system best suited to the conditions of the United States has been consistently carried out. That is to say, the manufacture of all war *materiel* has been taken in hand in the States on those European patterns and methods that appeared to be best. Solid steel armor was copied from Schneider, and in the case in which most notable success has been achieved, it has been made on his plan of hammering in preference to rolling. Gun steel was made in hollow cylinders on Whitworth's system of fluid compression, but while the aid of the European establishments referred to was invoked and fully acknowledged in starting, such progress has been made that it may be seriously questioned if Schneider could successfully compete with Bethlehem at the present moment. Certainly we know of no plate that has resisted successfully an attack equal to that defeated by the Bethlehem-Harveyed plate exhibited at Chicago, although Krupp exhibits a plate that has defeated a single blow of greater severity than those which fell on the Bethlehem plate. In our own country, Messrs. Vickers have, no doubt, produed plates which appear to be of the same excellence as those of Bethlehem. This, however, in no way invalidates our statement as to the lead taken by Bethlehem, for the remarkable success referred to was first achieved with the Harvey process at Bethlehem, and Europe has followed suit. To Schneider belongs the credit of introducing nickel into steel, but so well has this been carried out in the United States that at the present time it may be questioned if their examples of successful nickel-steel plates do not fully rival those of Europe. The most advanced and powerful plant for manufacture of steel forgings and armor, including the heaviest hammer existing, is to be found at Bethlehem, while rolling mills and still more extensive, though in some respect less powerful means of manufacture exist at Carnegie's works, near Pittsburg. The ability to which we refer has not been limited to success in processes of manufacture; it is seen in the system of control established by the government. It was decided from the first that private firms should be encouraged to develop resources on which the country could depend for the supply of elements or component parts of guns, while the government establishments should confine themselves strictly to the work of a gun factory—that is, to finishing and building up the elements supplied into finished guns. This has been successfully done so far as we are aware. We have heard of no accidents, no disappointments.

The 12 inch gun, shown as estimated for in the "Annual" of 1887, has a muzzle velocity of 2,100 feet per second, and an energy of 25,984 foot tons. The actual 12 inch gun given in the "Annual" for 1893 has the same, except that incidentally one foot ton more energy is shown. For armor a system of examination and testing has been organized, which we believe to be more thorough than any carried out elsewhere. As yet, probably all nations stand in somewhat the same position. Supplies of thin plates have been well tested, while thicker ones have been found more difficult to deal with. In the United States the delivery of plates of 17 inches is only commencing, but it is commencing under a very searching and complete system of examination and tests. There may, doubtless, be faults and weak points in connection with the supply of guns and armor, but we have not discovered them. There certainly is much to commend; nor is it to be wondered at. The conditions are singularly favorable. The United States is a great power, with unlimited resources. She is free from the pressure of the haste which is engendered by the danger of delay. She has men of notable inventive powers, coupled with the discernment to seize and apply anything good that already exists, with access to the results of experience acquired by other nations, and she has as much money as may be wished for. It is difficult to conceive circumstances more promising. Surely, if success does not follow, it could only be owing to gross corruption, or flagrant neglect, or perversity. Corruption has, we know, been often found in America, as elsewhere; but we think that our readers will bear us out in the statement that the history of the United States national expenditure for defense has been remarkably free from records of its influence.

Horse Power of a Whale.

An interesting study of the horse power of the whale has been made by the eminent anatomist, Sir William Turner, of the University of Edinburgh, Scotland, in conjunction with Mr. John Henderson, the equally eminent Glasgow shipbuilder. The size and dimensions of a great whale stranded several years ago on the shore at Longriddy furnished the necessary data for a computation of the power necessary to propel it at the rate of 12 miles an hour. This whale measured 80 feet in length, 20 feet across the flanges of the tail, and weighed 74 tons. It was calculated that 145 horse power was necessary to attain the speed mentioned.

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Notes from the World's Columbian Exposition.

(*Continued from page 275.*)

plainly habitations for separate families thus grouped into a community numbering perhaps 1,200 souls. One cannot help wondering what chance the boys and girls of such a cliff city would have for playing around its formidable ramparts, or what opportunity lovers might have for moonlight strolls. The theory is that the walls were built up solid from the floor of the shallow cave to the overhanging ledge. The masonry, though rude, is excellent. No tools of iron were used, and the mortar was laid on by hand, yet those walls have stood for centuries.

As we advance we pass on our right the Square Tower House, four stories high, though originally from seven to ten. It was built, like all these structures, many hundred feet above the foot of the cliff; and there its people lived as a peaceful community ages before French flats or Chicago tenement houses were thought of. The Balcony House opposite shows how the stories were separated by cedar beams, whose projecting ends were used to support porches overhanging the tremendous gorge below. The houses had doors and windows, and did not seem to have adopted, generally at least, the pueblo style of mounting by outside ladders. We saw ladders, however, in the collection. The stone doors were also shown, and the wooden loops and staples by which they were hinged. There are models of the High House and other fortifications. These names, it should be observed, were not used by the occupants, but were given by the roving cowboys or wandering tourists. The necessities of the exhibit bring the dwellings into proximity to each other, though the guides are careful to say that in fact they stand many miles apart. Some were found in the Mancos canyon, others in the McElme canyon, others again scattered over the Mesa Verde, or up and down the Montezuma valley. The cliff dwellings that I visited in Arizona were altogether of limestone; but those of this region were of red sandstone. Almost my only criticism on this exhibit is that while the cliffs are made to represent red sandstone the dwellings appear to be of limestone. On inquiring of Mr. H. L. Paquin, the artist who did the modeling, I was told that he had intended to be as exact as possible, but it seemed desirable for artistic effect to show a contrast in color. Usually the guides explain this fact.

Entering a grotto on our right, we find that it is merely to display in a novel and striking way numerous fine, large paintings by Mr. Alexis Fournier. These pictures are fitted into alcoves and lighted from above by electric lamps. Mirrors in the opposite wall multiply the seeming number of the views, and also give them the appearance of standing forth from the actual canyons amid the singularly soft, pure atmosphere of Colorado. Besides reproducing thus the dwellings already seen in model, the artist shows the Spruce Tree House, through whose ruins grew a tree with 167 rings; the Ruined Castle; the Long House, extending for 625 feet; and the She House (so named by a lady who had read Rider Haggard's novels), where was found a mummy in a remarkable state of preservation, and which is among the curiosities shown in another room.

Returning to the main canyon, we next inspect excellent reproductions of estufas of nearly the actual size of the originals. These sacred edifices were for tribal and ceremonial uses, sheltered the sacred fires, were entered by T-shaped doors, through which none but men were admitted. The largest shown had six recesses, The arrangements for heat and ventilation were on most approved scientific principles. A cold air duct let in the pure outside air. The fire was kindled nearly in the middle of the room. A stone screen was so adjusted as to compel the flame and smoke to curl over its top in order to escape through the flues in the wall behind it.

Full-sized models of the rock tombs were next shown, where the mummies were found among weapons, trinkets, and garments, under thick layers of dust, which, as it was said, was so poisonous as to make it necessary for the diggers to protect their nostrils with sponges while excavating. The extraordinary preservation of these remains and other contents both of the graves and estufas is due to their sheltered location, where, for centuries, they were never wet by rain, touched by frost, nor scorched by the sun. The paths by which the old inhabitants approached their dwellings, perched from 500 to 900 feet above the valley below, must always have been steep and difficult, and they are now worn away by the action of the elements.

The pioneers of the work of exploration, so far as this region is concerned, were Mr. B. K. Wetherell, his four sons, and his son-in-law, Mr. Mason. These, though ranchmen, were persons of a good education; and when they discovered the Cliff Palace while hunting stray cattle, they knew the value of the find. For the last five years these hardy men have devoted their whole time to explorations in Colorado, at first independently and more recently under the direction of the State.

The original collection made by the Wetherells, and two smaller ones since made by them, were purchased and added to the results of the H. Jay Smith exploring party. All these are shown in a long hall entered from the canyon already described and lighted by electricity. The museum boasts more than 2,000 relics, all from cliff dwellings.

And here particular mention should be made of the splendid display of similar objects from the same region, in the Colorado exhibit, in the adjoining Anthropological building, mostly gathered by the Wetherells and Messrs. McLoyd and Graham, and under the personal care of Mr. A. F. Wilmarth, who represents the interests of the State, and to whom the writer is indebted for valuable assistance in the line of reliable information. In company with Prof. F. W. Putnam, Mr. Frank Cushing, and other scientific gentlemen, we spent many hours in examining the contents of both museums, and were satisfied of their unquestionable genuineness and inestimable value. As I am writing for the general public and not to support any individual interests, I feel constrained to say that the entire collection, including more than 4,000 specimens, and the finest of its kind in the world, should, on some fair plan, be secured by the State of Colorado, which should also control future similar collections.

In referring, as I shall do now, to the contents of these two museums, no attempt will be made to indicate in which of the two the specimens mentioned were seen, for they serve to illustrate the same region precisely and ought finally to be united under one management. It will, furthermore, be out of the question for me to do more than to designate a few of the more important objects seen, without trying to exhaust the entire catalogue of curiosities, every one of which has its history and its lesson to teach.

Of course there were metates and rollers for grinding corn, and mortars and pestles for pounding acorns and grain. There were axes with and without handles, war clubs, hammers and mauls. The arrow tips, spear heads and knives were made of a great variety of materials, *e. g.*, flint, chert, quartz, jasper, slate, diorite, and petrified wood. Wooden arrow heads were also noticed, some of which were tipped with flint. Some celts were rude and others polished, some sharp and slender, and others blunt and clumsy. There were whetstones for sharpening dull tools. There were bone knives, marrow scoops, daggers, pickers, needles, and awls. I saw a large ceremonial dagger that must have come from California. There were chalcedony scrapers for dressing hides, and flint knives with wooden handles. Numerous farming implements were shown, and also curious turkey crooks for catching the turkeys which they had domesticated and trained to come at their whistle. All kinds of charms and toys were to be seen, also elaborate ceremonial headdresses, necklaces of perforated snail shells, bone beads, etc. I noticed shuttle cocks, buzz wheels, and other means of amusement. Mr. Cushing read to our satisfaction several hieroglyphic tablets found among the relics, all being prayers for rain.

Hundreds of sandals were displayed, and the slate forms or lasts on which they were shaped—although it is a query if these slates were not really tools for moulding pottery. One sandal was of raw hide; others of yucca leaves, whole or split; and others again of fine cloth. Some sandals were fitted with loops and cords for lacing. Delicate patterns were wrought on others, either in colors or in raised figure of exquisite workmanship. There were sand shoes to be worn in deep shifting sand, after the fashion of snow shoes. We saw baby-boards for carrying papooses; fire sticks for kindling fire by friction, and bags of tinder for making the task more easy; wicker cylinders full of rock salt; purses of cloth and of buckskin; knitted bags, socks and needle-cases. It has sometimes been doubted if these ancient people had textile fabrics except those made from the yucca flax. But I saw the cotton seeds, the carded cotton, cotton on the spindle, in the ball and skein, cotton wicks in the lamps, and as many as a hundred pieces of cotton cloth, some plain and others figured. Parts of looms were shown. Wonderful fabics of feather cloth were numerous, made by first weaving a coarse foundation of yucca cord, and then intertwining artistically the feathers of turkeys and other birds. Fur cloth was also made in the same way.

And then the pottery! Hundreds of ollas, bowls, mugs, pitchers, ladles, kettles with lids, vases of every pattern, lamps single and double, large and small, coarse and fine, plain and decorated after classic and oriental style. made one wonder if he were inspecting American relics or those from India, Greece, or Egypt. I saw one lovely vase inlaid with squares of mother of pearl. Others were painted red. There were paint pots and glue pots and vessels filled with pitch. Most of the pottery showed signs of use; but occasionally vessels were found as fresh and bright as if made yesterday. Some of the embellishments were of rare beauty. And it is essential for us to remember that these people had no knowledge of the potter's wheel. These articles were all shaped by hand or by slate tools. There was much coil pottery, some specimens being great jars holding from five to ten gallons. These were built up by long strips of clay crinkled and coiled one upon another. Many other vases were "slip-enameled" both within and without.

In some of the ollas, and also in leather pouches and cloth sacks, were found quantities of corn, six different kinds being noted; also beans, pumpkin seeds, grass-seed, and seed of the portulacca. Experiments made by Mr. Wilmarth and others failed to make these grow. But Mr. Cushing told me that he succeeded in sprouting corn from more southern cliff dwellings. I was also informed that Baron Nordenskiold, of Norway, took specimens home with him and succeeded in effecting their germination by the aid of electricity. The failure in other cases may have been due to the fact that the germs had been destroyed by heat, cold, alkali, or by the attacks of insects.

But *who* were the people that cultivated these grains, ground the corn and made it into bread? Who wove and wore these ancient garments, admired these trinkets, handled these tools, fought with these weapons and worshiped in these estufas? Hundreds of mummies made silent but impressive answer. These were the cliff dwellers themselves. And they were a noble race! The skulls set in long rows behind the glass door were uniformly well shaped, except for the slight flattening by the baby-board, which was applied to the back of the head instead of the forehead. The care with which the living were attended was proved by our finding several padded crutches and surgical instruments in the museums; and the veneration for the dead was shown by the pains with which they were dressed for their long repose. Each body was placed with its arms crossed on the breast, and the knees drawn up to the chest, then wrapped in a large winding sheet of cotton cloth, next in a costly robe of feather cloth, and finally in matting of grass, reeds or willow twigs. The burial was in a tomb, along with the treasures that had been most prized in life. How strange it seems that tall warriors, matrons, graceful youth, and even tiny infants, after having been peacefully interred for ages, should now have been exhumed, freed from their cerements, and shelved for inspection at Chicago!

The framework of these people was usually perfect. The flesh was dried, like that of the Egyptian mummies they resemble, only being due to desiccation instead of embalming. I noticed that the teeth were remarkably sound, not more than five or six in the entire collection showing any sign of decay. The hair was soft and abundant, varying in color from a light brown to jet black, and occasionally to gray. Possibly these lighter hues were due to bleaching by ammonia or alkali.

We noticed among these withered human remains one most pathetic sight—a woman with her babe in her arms. Around the infant's neck was a tightly drawn rope, evidently made of the mother's own hair. The story thus suggested was that the woman having died a natural death, her child was ceremonially strangled to save it from starvation, or else in order that the mother and child might pass on to the spirit-land in company. Those ancient people had their tragedies and their festivals, their joys and sorrows, much as we do now; but for them life's banquet ended long ago!

How long ago? Who can tell? When we ask after their age, we at once embark on a sea of speculation. They do not seem to have had any knowledge of the metals, except as they used the ores for pigments; and this may be regarded as an indication of high antiquity. The stories told me as to the finding of bronze bells among their ruins are traceable to discoveries in Casa Grande and Los Muertes. Yet for my part I cannot regard all cliff dwellers as contemporaries. They were men of enterprise and commerce, as we have tried to show from the remarkable variety we have seen in their relics. Mr. Cushing told me that he had found living Zunis whose great-grand-parents were born and lived in cliff houses. Hence, doubtless, there were cliff men who witnessed the Spanish conquest, and who may even have been disciples of the apostolic Franciscans that bore the cross wherever their military comrades carried the sword. The cross appears in the ancient symbolism of the cliffs, not only in the form of the mysterious suastica, but in the form of the Grecian and the Maltese cross. Yet this fact should not be pressed too far, for there are other ways to account for the presence of the sacred emblem, which it is well known antedated the Christian era.

Many points of resemblance are to be seen between the cliff dwellers and the modern Pueblo Indians, and the evidence is strong that the latter are the direct, though remote, descendants of the former. The best authorities fix one thousand years as the minimum and three thousand years as the maximum period that has elapsed since the cliff dwellers played their part as a distinct race; although their descendants have, from time to time, under stress of danger or for other reasons, reverted for a season to the old habitations. Yet we cannot deny that it is surprising—even astounding—that such relics as have been now described should have been kept intact so long, and in such an admirable state of preservation. Regarded from any point of view, the exhibit and accompanying museums of the cliff dwellers, at the World's Fair, are wonderful.

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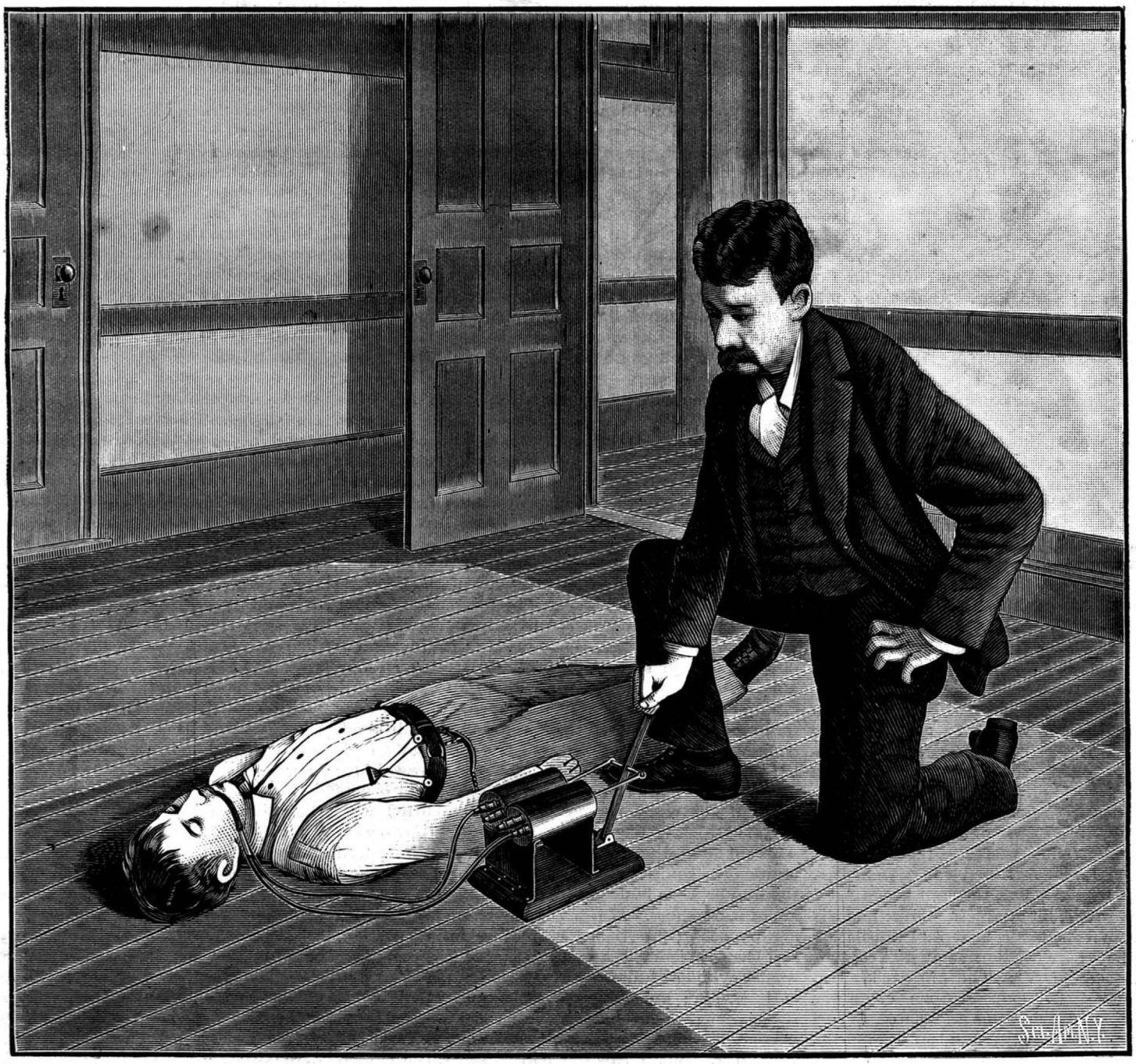
NEW APPARATUS FOR ARTIFICIAL RESPIRATION.

In cases of apparent death from drowning, asphyxiation, or from certain kinds of poisoning, it is often a question whether animation is only suspended, or whether life is really extinct. The preservation of life is the strongest motive for action in all animate beings, and the restoration to consciousness and a normal condition of the apparently dead is always regarded of paramount importance in human affairs. Where there is life, or even the faintest suspicion that death has not really taken place, every effort is made, regardless of labor or expense, to save life; but it not infrequently happens that the means used are insufficient, or there is a lack of knowledge of what to do and how to do it.

Mr. William F. Desant, of this city, has invented an instrument for producing artificial respiration, which consists of two cylinders, a handle connected with two plungers, two inlet and two outlet valves, and rubber tubes and mouthpiece or tracheal tube, which may be regulated to suit the requirements of any case, both in the number of respirations per minute and the volume of air injected into and removed from the lungs. The cylinders have a capacity of 20 to 30 cubic inches, which is about the range of the capacity of human lungs. This being the maximum, the amount of air is reduced more or less, according to the requirements, by simply reducing the stroke of the pistons. The instrument is constructed so that it can be easily and quickly taken apart after use, and disinfected by immersion in a solution of carbolic acid or chloride of mercury. The respirator not only forces air into the lungs, but also draws it out without volition on the part of the patient. For this reason it is especially useful in advanced stages of phthisis, where the effort of breathing is exhausting to the patient. In cases of anæsthesia resulting from the use of ether, morphine, cocaine, or other drugs, also in asphyxiation from illuminating gas, poisoning, or electric shock, this respirator is effectual in restoring the patient by maintaining respiration after the lungs are incapable of performing their proper office.

In cases of still birth, where all other methods have failed, it is said to give excellent results. In case of diseased lungs, the device is used for applying medicated air, ozone, or other remedial agents. It is also used to give relief in cases of emphysema and asthma. In cases of drowning, the water is drawn from the lungs and pure oxygen substituted until the lungs are able to act unaided. The apparatus has the indorsement of physicians and surgeons.

The address of the inventor is the Equitable building, New York City.



THE DESANT RESUSCITATOR.

Infectious Pneumonia.

Dr. Orranos, of San Luis Potosi, Mexico, read an interesting paper before the recent Pan-American Congress, Washington. His subject was "Pneumonia: its Dangers as an Infectious Disease." He referred to the three climates of Mexico—Tierra Fria, Templado, Caliente—or its cold, temperate, and coast or tropical climate. He dwelt on the distribution of pneumonia from Zacatecas in its highlands to Campeachy on the Gulf of Mexico. March and April, at the close of the Mexican winter, gave the heaviest death rate. In some places it was more fatal than others. He cited much of general interest regarding infected houses, citing case after case in the same house, visitors to pneumonics having contracted the disease and taken it to others. In other words, its propagation by individuals and air. Malaria and pneumonia had a *role* frequently observed in Mexico. He deems the disease highly infectious. He cited a case of a man who died of pneumonia. A month later his clothing was sent to a family. Soon after two children in that house were ill with the disease. Another illustration was that of a woman who nursed a pneumonic—sleeping in the same room; she likewise contracted the disease.

An examination of records of cases of pneumonia in given localities had proved very instructive. In two years thirty-one cases had been traced to infected houses, case after case in the same house. The germ of the disease, the pneumococcus, he deemed almost indestructible in Mexico.

Our Domestic Water Commerce.

A man must travel up and down the Great Lakes and navigable rivers of this country to gain even a faint idea of the extent of America's domestic water commerce. Some very interesting facts and figures, however, bearing on this matter were cited by Mr. Thomas J. Vivian, of the Census Bureau, in his recent address before the World's Water Commerce Congress at Chicago. According to the traffic records compiled by the census there were in 1890 no less than 22,079 craft conducting transportation on what may be called "domestic waters." Of these 2,282 were steamers and 6,837 were sailing vessels engaged in carrying freight and passengers, their united tonnage being 2,912,693 tons; 455 were ferry steamers, with a tonnage of 146,099 tons; 1,944 were steamboats engaged in towing freight-laden barges, with a tonnage of 145,805 tons, while the barges so towed numbered 10,561, with a tonnage of 4,008,847 tons. The total tonnage of this traffic fleet of 22,079 craft was 7,213,434 tons and its value $184,126,053.

As may be imagined, this great fleet did a business proportionate to its extent. According to the report of operations made to the authorities, 168,078,320 tons of freight were moved in a year, while the passenger list numbered 199,079,577. It may surprise the reader who does not realize the extent of navigable waters within the bounds of this country to know that in the pursuit of business these busy craft traveled 107,456,164 miles. Besides possessing the largest lake system in the world, Uncle Sam has a glorious waterway of 23,505 miles of navigable rivers—which only lacks a little, as Mr. Vivian says, of being long enough to belt the globe. Under these circumstances it isn't strange that our domestic water commerce has boomed in the past, and is destined still to boom.—*Boston Globe.*

A 1,200 H. P. Turbine for Niagara.

Another immense water wheel has just been shipped to Niagara Falls by James Leffel & Co., of Springfield, O. It is a duplicate and of nearly the same power as one which was shipped some six months ago to the Cliff Paper Company, and is intended for the same parties.

The wheel is of the new type on horizontal shaft, and is known as the James Leffel double discharge turbine, the entire weight being thirty tons. The water will be conducted to the wheel from a canal near the top of the cliff by an eight-foot pipe, extending downward until it reaches the mill, located near the foot of the cliff. The water will enter the cylinder casing of the wheel from below, passing upward a few feet, filling the case, and thus obtaining the head pressure.

The head will be about 130 feet; the wheel being some 67 inches in diameter, a speed of 225 revolutions will be obtained, and almost or quite 1,200 h. p. developed.

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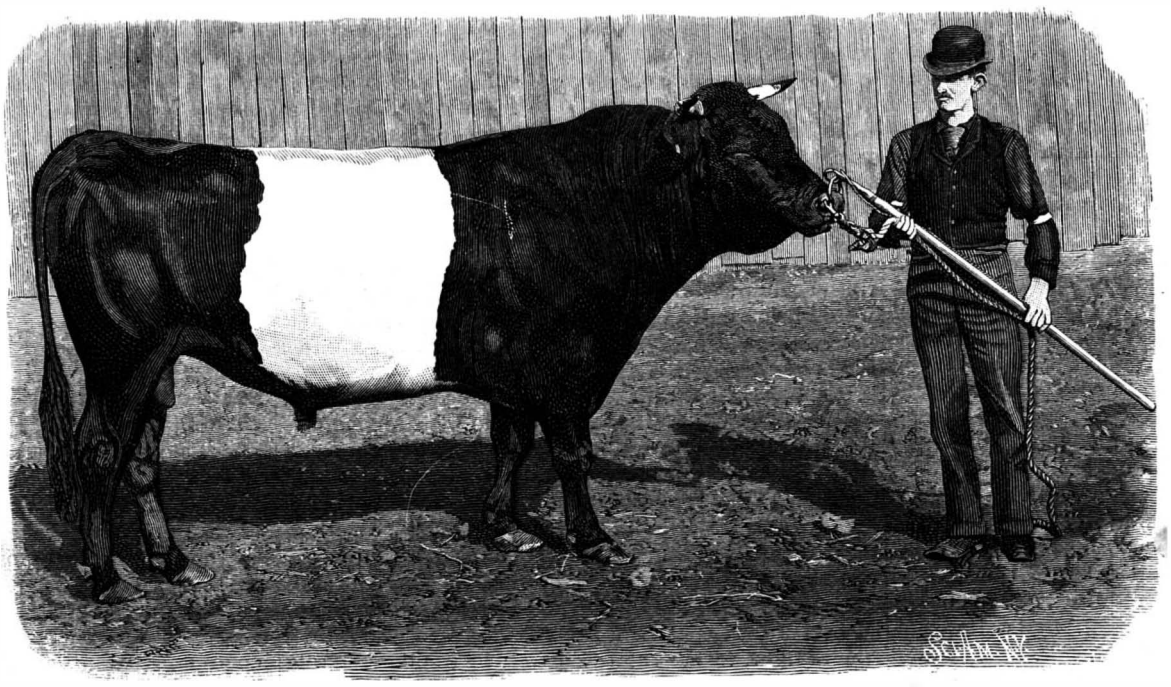
PRIZE CATTLE AT THE WORLD'S COLUMBIAN EXPOSITION.

Live stock forms an important display at the Fair and is interesting not only to the stock raiser but to the gentleman farmer as well. The huge live stock pavilion is crowded during the judging. Stock breeders from the various parts of the country went to Chicago when the Exposition authorities announced that there would be an exhibit of registered stock only. There were two thousand entries in some of the classes and it is safe to say that the exhibition contains representative stock from nearly all parts of the civilized world. The greatest part of the stock exhibited is of domestic origin, and is furnished both by stock breeders and the owners of fine cattle who are in many cases members of cattle associations. Probably the most interesting cattle on exhibition are the Holsteins and the Dutch belted cattle. The Dutch belted cattle are of medium size, fine boned, compact and well built. In color they are black, with a continuous white belt around the body, the white being pure white, the black jet making a beautiful contrast. This type and color were established by scientific breeding. They are controlled by the nobility in their native country, and present a novel feature in the landscape, grazing in the lowlands of Holland. In weight the cows vary from eight to twelve hundred pounds and the bulls reach sixteen to twenty hundred. The calves produced are usually of large size. The Dutch belted cattle should not be confounded with the Holsteins, which belong to a distinct family. The Dutch Belted Cattle Association will give a medal to all winners of prizes at the Columbian Exposition for standard bred Dutch belted cattle. We illustrate two of the prize winners, a Holstein and a fine example of Dutch belted bull.



PRIZE DUTCH BELTED BULL AT THE WORLD'S COLUMBIAN EXPOSITION.

Thiocamf.

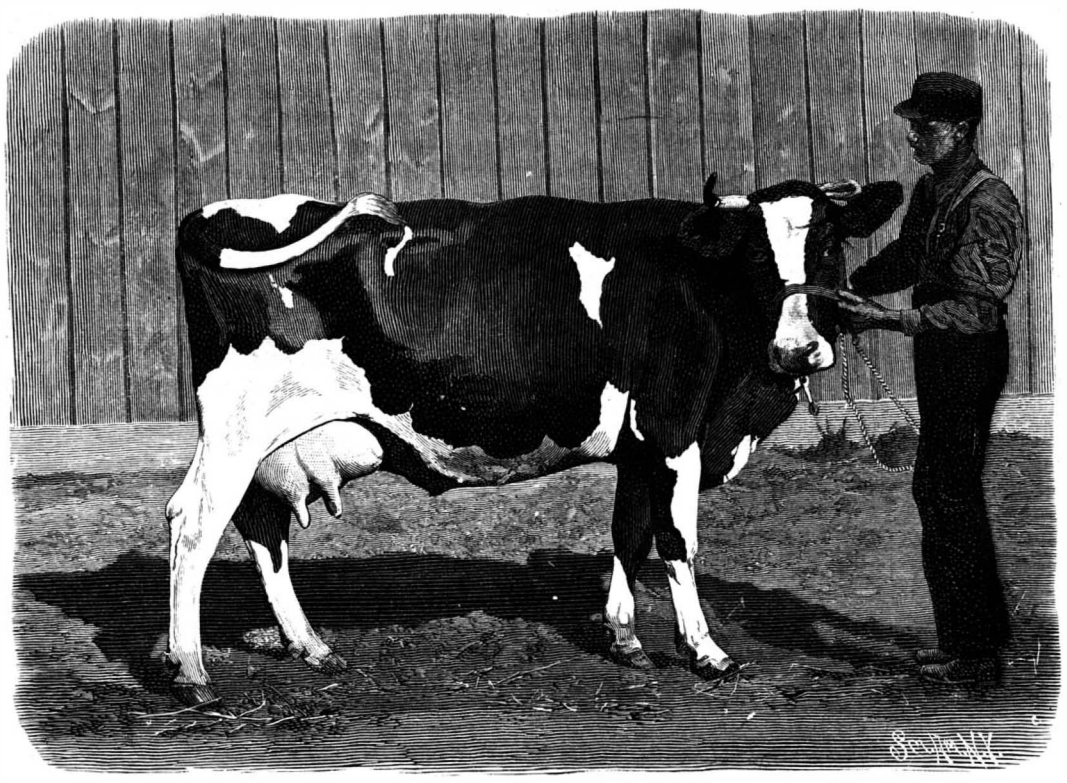
Duffey (*Dublin Journal of Medical Science*, May, 1893) has been led to use thiocamf as an intestinal antiseptic, a surgical application, and an antiparasitic in cutaneous affections. His communication has already been briefly alluded to in this journal.

Thiocamf is described by Professor Emerson Reynolds, its discoverer, as a "liquid which results when sulphur dioxide gas is brought in contact with camphor." In this liquid are dissolved several substances destructive of bacteria, among them benzoic acid and phellandrene. Thiocamf can be preserved without pressure in bottles at ordinary temperatures, but on its exposure in thin layers a steady evolution of large volumes of sulphur dioxide gas, charged with the vapors of other disinfectants, takes place. From this action it has been much used for atmospheric disinfection, and, for the same reason, Duffey has applied it to the uses noted. For internal administration it was combined with pure butter fat in the proportion of ten per cent of thiocamf. Of this, ten grains were given in capsule every two or three hours for four doses. The capsules were sometimes coated with keratin, that they might pass through the stomach and be dissolved in the intestines.

The drug was thus used in a case of typhoid fever, in a case of phthisis in which the patient was suffering from pyrosis, in a case of dilatation of the stomach, and in a case of alcoholic peripheral neuritis in which the patient had fetid alvine evacuations. In all of these the signs of fermentation became less marked and the character of the movements improved. In two cases of scabies a four per cent solution in olive oil effected rapid cures. In bedsores and unhealthy ulcerations it was used in oily solution (four to six per cent) with the effect of quickly removing fetor, diminishing the discharge, and promoting healing. No ill effect was noted in any case.—*Medical Record.*

Chemical History of the Atmosphere.

In the *Chemical News* Dr. Phipson gives the chemical history of the atmosphere from its origin to the present day, in accordance with the results of his observations and experiments, particulars of which we have published from time to time. Premising that the matter composing the earth was originally in a gaseous condition at such a temperature that no compounds could exist, he assumes that, when a solid crust later covered an internal molten mass, water was condensed upon the surface and a primitive atmosphere of nitrogen surrounded the globe. Into this atmosphere large quantities of carbonic acid and water were evolved by volcanic action, bnt there was no free oxygen. Plants then made their appearance, and, in vegetating, evolved oxygen copiously, deriving this element from the carbonic acid supplied by volcanic action. When a certain proportion of oxygen was attained, animal life became possible, and duly appeared. At the same time the proportion of carbonic acid became less, the carbon being stored up as coal, peat, lignite, etc. As these processes proceeded animal life of higher order appeared, the development of the nervous system coinciding with the increase of oxygen in the air. As evidence that the composition of the atmosphere is still slowly changing, it is stated that the latest and most careful determinations of carbonic acid in the air have shown a decided decrease (0·05 to 0·03) in the last fifty years.



PRIZE HOLSTEIN COW AT THE WORLD'S COLUMBIAN EXPOSITION.

The Production of Prussic Acid from Sugar.

The conversion of an absolutely innocuous substance into one of a powerfully toxic nature by means of a series of simple chemical operations, though not a rare phenomenon, is well-illustrated in a reaction recently observed by three chemists—Messrs. Burls, Evans and Desch—in which prussic acid proved to be one of the products of the action of nitric acid upon sugar. It is well known that by acting upon sugar, sawdust or cellulose with nitric acid, oxalic acid in tolerable quantity is produced. In the course of such an experiment the chemists above named noticed the smell of prussic acid just after the first violence of the reaction had ceased and the evolution of nitrous fumes had diminished. Subsequent examination proved beyond doubt that prussic acid in considerable quantity was present in the liquid, and on submitting the liquid to distillation, prussic acid was found in the condensed products. A larger yield of the acid was obtained when the nitric acid was allowed to drop slowly into the sugar solution from a tap funnel. Caramel was acted upon similarly, although the quantity of prussic acid produced was less than before. The production of hydrocyanic acid would appear to be due to the reduction of the nitric acid to nitrous acid and to the action of this acid upon the carbon ensuing on the decomposition of the sugar. Finely divided carbon itself was found to give prussic acid on distillation after treatment with nitric acid, and the same result was obtained when cane sugar was acted upon by nitrous acid by submitting the sugar first to the action of nitrite of potassium and then acidulating with sulphuric acid. On this hypothesis the reaction may be thus represented: $2HNO_3 + C = 2HNO_2 + CO_2$ and $HNO_2 + 2C = HCN + CO_2$. This action is evidently of interest from a theoretical point of view, and only shows how we may be led astray in being content with the simplest explanation of certain phenomena. The text books give oxalic acid as the product of the action of nitric acid upon sugar, but now must be added the observation that hydrocyanic acid is a compound simultaneously produced.—*The Lancet.*

The Moon's Face.

Mr. Gilbert's address as retiring president of the Washington Philosophical Society is an ingenious array of arguments in favor of the impact theory to account for the origin of the features of the moon's face. His hypothesis is, that material constituting the moon once surrounded the earth in the form of a Saturnian ring; that the small bodies of this ring coalesced, first gathering around a large number of nuclei, and finally all uniting in a single sphere, the moon; that the lunar craters are the scars resulting from the collision of the moonlets.

This hypothesis reconciles the impact theory with the circular outline of the lunar craters and explains the abundance of colliding bodies of large magnitude. The author discusses the probabilities of the formation, according to his theory, of lunar wreaths, central hills, arched inner plains, level inner plains, and the association of inner plains with central hills. He finds his theory adequate to explain all these phenomena, as well as the peculiarities known as furrows, sculpture, rills and rill pits. In regard to the "white streaks" Mr. Gilbert quotes, as in accordance with his own idea, an unpublished suggestion made by Mr. William Wurdeman, that "a meteorite (moonlet) striking the moon with great force spattered whitish matter in various directions."

During the growth of the moon, many of the moonlets must have collided with the earth and formed impact craters which have been obliterated by erosion and sedimentation. It is possible, the writer suggests, that these collisions imitated not only the differentiation of continental and oceanic plateaus, but the series of geographic transformations of which geologic structure is the record. (Phil. Soc. Washington, Bull. vol. xii., 1893.)—*American Naturalist.*

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Correspondence.

Prof. Brooks Discovers a New Comet.

To the Editor of the Scientific American:

Early this morning it was my good fortune to discover a fine new telescopic comet, while searching the eastern heavens, which were beautifully clear. The position was R. A. 12 hours 21 minutes, declination north 12° 55′, with a slow motion in a northeasterly course. The comet is bright telescopic, with a short tail.

Further particulars will be communicated to your readers as soon as the observations are secured.

WILLIAM R. BROOKS.

Smith Observatory, Geneva, N. Y., Oct. 17, 1893.

How to Preserve the Egyptian Obelisk.

To the Editor of the Scientific American:

I see from a Philadelphia paper that some one in New York proposes that the obelisk in Central Park should be gilded to preserve it from further decay. Gilding will not do any good. Why not copper-plate it with a moderately thick coat of copper? A coating of 6 to 8 ounces of copper per square foot, applied by the electrolytic method, would not obliterate any of the carvings on its face and would preserve it for all time. If the color of the copper should be objectionable, a coat of aluminum could be applied over the copper, which, after some months' exposure, would give it the appearance of stone. There would be no difficulty in applying the copper. The obelisk is already soaked with paraffine, and it only needs to be plumbagoed to be in a condition to receive a deposit, which could be applied in the way that it is intended to electroplate ships' bottoms with copper, viz., by plating it in sections which overlap. The cost would not be high, and it would not require much time to do it.

J. D. DARLING.

Frankford, Philadelphia, September 25, 1893.

Natural History Notes.

The Parasol Ant.—The action taken by the legislature in regard to the destruction of the parasol or leaf-cutting ant in Trinidad has drawn fresh attention to the habits of this insect, and very interesting information has been published respecting it. The most accessible account hitherto existing is that given by Belt in "The Naturalist in Nicaragua." The results of recent investigations have confirmed this author in the supposition that the ants cut up the leaves of plants and bring the pieces into their nest to serve as a pabulum on which to grow a fungus. In fact, these pieces are used to form an underground mushroom bed, and the ants use the conidial stage of the fungus for purposes of food for themselves and their larvæ. The Hon. J. E. Tucker, Director of Public Works, Trinidad, gave some interesting particulars of the habits of the parasol ant in the *Journal* of the Trinidad Field Naturalists' Club for August, 1892. He had two nests on a table in his house. In one nest with a queen the ants readily supplied themselves with pieces of leaves from plants placed near their feeding ground. Each forager dropped his portion of leaf in the nest and it was taken up by a small worker and carried to a clear space to be cleaned. It was then taken in hand by the large workers, which, after licking it with their tongues, reduced it to a small black ball of pulp. These balls were built on the edge of the already formed fungus bed and slightly smoothed down. The new surface was then planted with portions of the fungus brought from the older parts of the nest. "Each piece is planted separately, and the ants know exactly how far apart the plants should be. It sometimes looks as if the bits of fungus had been put in too scantily in places, yet in about forty hours (if the humidity has been properly regulated) it is all evenly covered with a mantle as if of very fine snow."

In an exhaustive memoir on the "Mushroom Gardens of Some South American Ants," recently published by Alfred Moller, who studied the subject on the spot, the statement made by Belt respecting the cutting up of leaves by ants for the formation of a pabulum on which a fungus is grown that serves as food has been corroborated. The method of leaf cutting, the various species of plants used, and the formation of the "mushroom gardens" are given in detail; but the most interesting and hitherto unknown portion is that relating to the fungus cultivated by the ants in their "mushroom gardens." A series of cultures has proved this to be the mycelium and conidial stage of a fine agaric, which, according to the Friesian system, would belong to the sub-genus *Pholiota* of *Agaricus*, but which has been called by Moller *Rozites gongylophora*. The agaric grows in dense tufts, and has a purplish, scaly pileus, 10–16 cm. across. The highest form of the fungus does not occur normally in the "mushroom gardens," but only the mycelium and conidial forms, and it is the last named conditions that are eaten by the ants.

Observations were made by Moller on the "mushroom gardens" of ants belonging to the following genera: *Atta* (*Acromyrmex*) Mayr. (*A. discigera*, Mayr.; *A. hystrix*, Latr.; and *A. coronata*, Fabr.); *Apterostigma*, Mayr.; and *Cyphomyrmex*, Mayr.

Although Moller did not directly study the fungus cultivated by the Trinidad species (*Œcodoma cephalotes*) there is now little doubt that it is identical with that described by him as *Rozites gongylophora*.

The Sense of Vision in Ants and Bees.—It is generally assumed not only that the world really exists as we see it, but that it appears to other animals pretty nearly the same as we see it. A little consideration, however, is sufficient to show that this is very far from being certain, or even probable. In the case of insects, moreover, the mode of vision is still an enigma. They have (at least many of them have) a large compound eye on each side, and ocelli, generally three in number, situated on the summit of the head. The compound eyes consist of a number of facets, each situated at the summit of a tube, to the base of which runs a fiber of the optic nerve. The structure of the ocellus and that of the compound eye are different, and it does not seem possible that the ocellus should be derived from the compound eye, or *vice versa*. On the contrary, both seem to point back to a less developed ancestry. Starting from such an origin, an increase of the separate elements and an improvement of the lens would lead to the oculus, while an increase to the number of eyes would bring us to the compound eye. On the other hand, there are reasons for believing the different kinds of eyes to be of distinct origin.

It seems clear that the picture produced by the ocelli must be altogether different from the picture given by the compound eye, and we may reasonably conclude that the two organs have distinct functions. It used formerly to be supposed that the compound eye was for distant vision and the ocelli for near vision. Claparoedr, however, maintains the opposite theory, while Mr. Lowne regards the ocelli as incapable of producing anything worthy of the name of an image, and suspects that their function is the intensity in the direction of light, rather than vision. The ocelli, or simple eye, sees in the same way as ours do, that is to say, the lens throws an image on the back of the eye, which we call the retina. In that case they would see everything really reversed as we do, though long experience has given us the right impression. The simple eye of insects thus resembles ours in this respect. As regards the mode of vision of the compound eyes, there are two distinct theories.

According to one, that is the mosaic theory of Muller, each facet takes in only a small portion of the field, while, according to the other theory, each facet acts as a separate eye. This latter view has been maintained by many high authorities, but it is difficult to understand how so many images could be combined into one picture. Some insects have more than twenty thousand facets on each side of their head. No ants, indeed, have so many; but some there are that have not less than one thousand eye facets. The theory, moreover, presents some anatomical difficulties. Thus in certain cases there is no lens, and consequently there can be no image. In some it would seem that the image would be formed completely behind the eye, while in others, again, it would be in front of the receptive surface. Another difficulty is that any true projection of an image would in certain species be precluded by the presence of impenetrable pigment, which only leaves a minute central image passage for the light rays. Again, it is urged that even the sharpest image would be useless, from the absence of a suitable receptive surface, since the structure of the receptive surface, belonging to each facet, seems to preclude it from receiving more than a single impression. The prevailing opinion among entomologists now is that each facet receives the impression of one pencil of rays, so that in fact the image formed in a compound eye is a kind of mosaic. On the other hand, this theory itself presents many difficulties. Those ants which have few facets must have an externally imperfect vision. Again, while the image produced in the retina of the ocellus must, of course, be reversed, as in human eyes, in the compound eye, on the contrary, the vision on this theory would be direct. That the same animal should see some things directly and others reversed, and yet obtain definite conceptions of the outer world, would be very remarkable. But while it is difficult to perceive how ants see, yet they do see.—*Science Gossip.*

A Fighting Stratagem of the Crawfish.—The common crawfish (*Palinurus vulgaris*) has many points of interest, and not the least curious is his plan of combat when matched wth a powerful antagonist. Without chelate limbs, he seems weak and defenseless. One is at first inclined to commiserate this apparent want of means alike of offense or defense, especially in comparison with his kindred, the lobsters, armed so well with powerful seizing chelæ. That he had means of defense seemed probable; but it is only within the last few days that this was satisfactorily demonstrated. Without any particular intention in view, we had dropped a medium sized lobster into the tank containing two large *Palinurus*. At first no sign was given, but in a little while we were attracted by a loud noise as of a skirmish, and had an inimitable object lesson in crawfish warfare. The larger of the two crawfish apparently resented the intrusion of the lobster, and was determined upon ejection. There was a good deal of preliminary sparring, but the fight, which promised to be protracted, ended suddenly in a most unexpected manner. Making a sudden twist, the crawfish got above the lobster crosswise, and suddenly snapping his powerful tail, jammed the body of his antagonist in the fold, thus impaling him on the sharp downward spikes of the pleura that are so conspicuous objects in a side view of *Palinurus*. The lobster was put quite *hors de combat*, for his body was terribly mutilated by the sharp spines, which had pierced his armor as though it were tissue paper. Besides this instance, cases are known where persons incautiously handling the crawfish have received wounds on the arm inflicted by a similar sudden flap of the tail.—*Jas. Hornell, in Natural Science.*

Habits of the Secretary Bird.—As soon as the secretary bird, or snake eater (*Gypogeranus serpentarius*), of South Africa, discovers a snake, it advances toward it, without hurry and without hesitation, and when withing striking distance it immediately elevates its crest and the feathers of the neck, and, without losing any time, delivers a blow with its foot. If the snake has avoided the blow and attempts to strike in return, the bird interposes a wing, thus receiving the deadly fangs harmlessly upon the long feathers, and immediately strikes again.

The fight is then virtually over, for if the secretary gets in a single blow the snake's back is broken, and the bird, like lightning, plants its foot firmly on the reptile's neck and head, pressing them into the ground, while it delivers the *coup de grace* with its beak, and then deliberately swallows the snake whole, beginning at the tail, and, just before the head disappears, giving it a parting rap on the ground.

But there is nothing refined about the secretary bird's appetite, for one writer says he found inside one three serpents "as long as his arm," eleven lizards seven inches long, twenty-one tortoises about two inches in diameter, "besides a large quantity of grasshoppers and other insects;" or, in other words, seven and a half feet of snake, six and a half of lizard, three and a half of tortoise, and, say, a yard of miscellaneous trifles!

The secretary bird is protected by the Cape authorities for the immense public benefit it confers in eating poisonous snakes, and a penalty is attached by law to its destruction. And, if it were necessary, hundreds of eyewitnesses could be called to prove its right to the title of "Serpentarius." Curiously enough, too, this bird can be trained, and is trained, to protect poultry yards, not only from snakes, which are all too fond of eggs, but from other birds of prey.—*St. James's Budget.*

The Perfume of Flowers.—The following conclusions are the result of the researches of Mr. E. Mesnard upon the mode of production of the perfume in flowers:

1. The essential oil is generally found localized in the epidermic cells of the upper surface of the petals or sepals. It may exist upon both surfaces, especially if the floral parts are completely concealed in the bud. The lower surface generally contains tannin or pigments derived therefrom.

2. The chlorophyl seems in all cases to give rise to the essential oil.

3. The disengagement of the perfume of the flower makes itself perceptible only when the essential oil is sufficiently disengaged from the intermediate products that have given rise to it, and is found, in a manner, in a ratio inverse to the production of tannin and pigments in the flower.

This, says Mr. Mesnard, will explain (*a*) why flowers with green petals have no odor, (*b*) why white or rose-colored flowers are most often odoriferous, (*c*) why the compositæ, which are rich in tannin, have the disagreeable odor that they are known to possess, and (*d*) why the white lilac and forced roses take on a finer perfume.

A Carnivorous Caterpillar.—Prof. Perrier, of the Paris Museum, recently stated to the Academy of Sciences that Mr. Rouzand, *maitre de conferences* at the Faculty of Sciences of Montpellier, has studied the habits and metamorphoses of a remarkable butterfly whose caterpillar lives upon the olive tree. This lepidopter was briefly described by Rambour sixty years ago, under the name of *Erastria scicula.*

Unlike its fellows, the caterpillar of the *Erastria* does not eat the leaves of the tree upon which it lives, but, on the contrary, despoils the latter of its parasites. It is not herbivorous, but carnivorous, and feeds upon the coccinellidæ that abound upon the olive tree and often cause the death of it.

In addition to this peculiarity, this singular animal presents others of great interest. In its adult state it is so colored as to exactly simulate the excrement of the sparrow. While very young it hides itself under the carapace of the coccinellidæ that it devours. When a little older it spins a ring of silk around such carapace, and thus enlarges its dwelling in such a way that it shall always be adapted to its own size. Let us add that it conceals this addition under the debris of coccinellidæ and the spores of *Fumago*, a fungus parasite of the olive tree.

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BEVELING AND SILVERING MIRRORS.

The making of glass mirrors for commercial purposes was probably first developed in Venice. Looking glasses in large sheets were exported from Venice in the last part of the 17th century. Mirrors became articles of household furniture in the early part of the 16th century. Previous to that time small pocket mirrors were carried at the girdles of ladies. They had no covers, but were furnished with a short handle. The old process of amalgamation is about done away with. The process of silvering was first introduced in 1840, through a discovery made by Baron Liebig. A horizontal double-bottomed metallic table is used, which is heated with steam to from 35° to 40° C.

The glass to be silvered is cleaned thoroughly with wet whiting, then washed with distilled water and prepared for the silver with a sensitizing solution of tin, which is well rinsed off immediately before its removal to the silvering table. The table being raised to the proper temperature, the glass is laid and the silvering solution at once poured over it before the heat of the table has time to dry any part of the surface of the glass. The solution used is prepared as follows: In ½ liter of distilled water 100 grammes of nitrate of silver is dissolved, to this add liquid ammonia (sp. gr. 0·880) 62 grammes. The mixture is filtered and made up to 8 liters with distilled water, and 7·5 grammes of tartaric acid dissolved in 30 grammes water are mixed with the solution. About 2·5 liters are poured over the glass meter to be silvered. The metal immediately begins to deposit on the glass, which is maintained at about 40° C. (104° Fah.), and in a little more than a half hour a continuous coating of silver is formed.

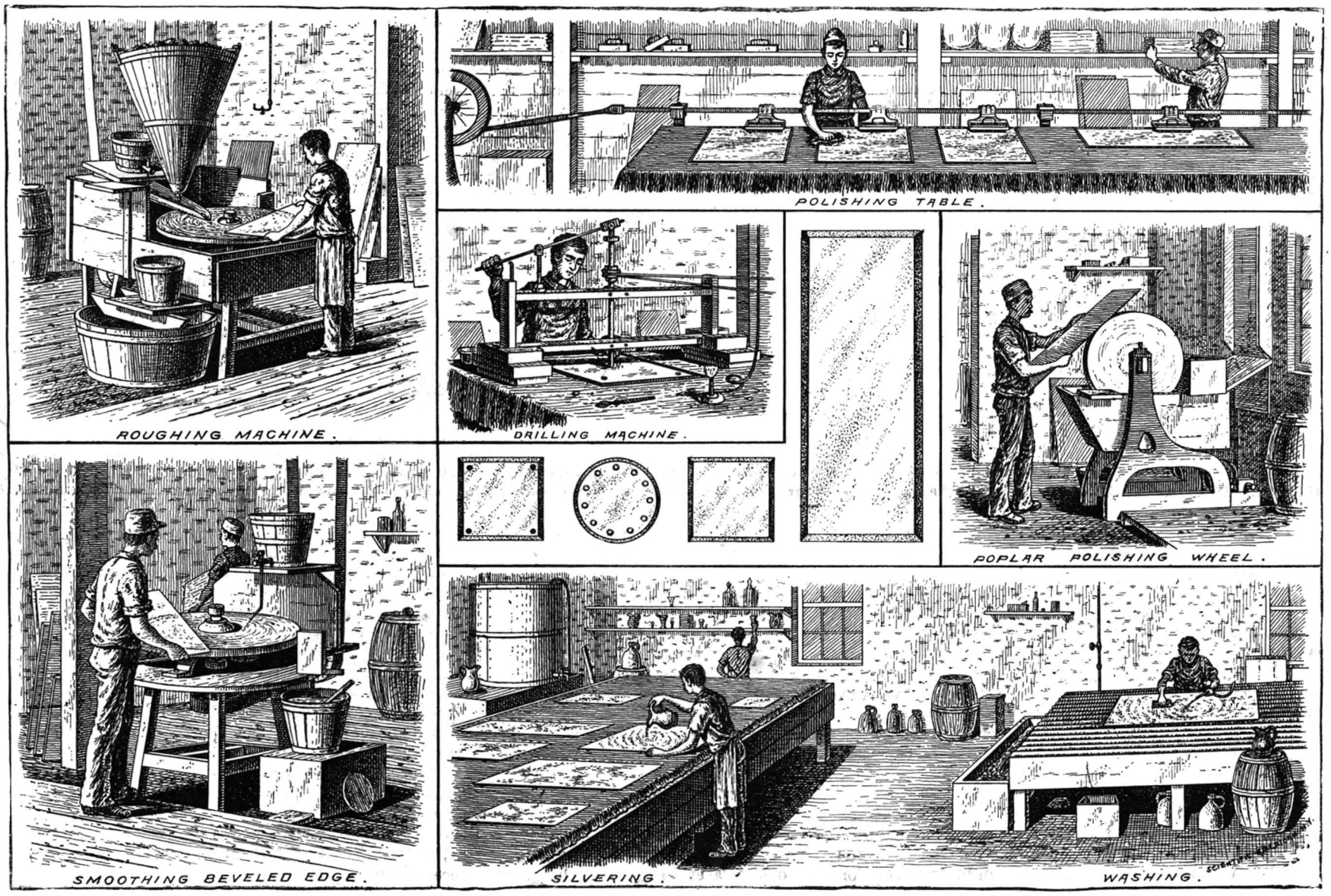
The silvered surface is then cleaned by very cautiously wiping with a very soft chamois rubber and treated a second time with a solution like the first, but containing a double quantity of tartaric acid. This solution is applied in two portions, and thereafter the glass is once more carefully cleared of all unattached silver and refuse and removed to a side room for backing up. The plate glass before silvering is first beveled on the roughing machine. To bevel the edges the sheet of glass is held up slightly on the edge by the attendant on to a horizontal revolving iron wheel. This wheel is about 30 inches in diameter and about 1½ inches in thickness and is slightly curved on top. Water and white Rockaway sand is added from a large wooden cone-shaped hopper, which causes the wheel to grind down the edges of the glass.

The wheel is capable of beveling one foot in about twenty minutes. From the rough beveling machine the glass is run over a 30 inch emery wheel. This cleans and takes out the sand from the pores of the glass. From the emery wheel it passes to a horizontal New Castle stone wheel about 30 inches in diameter and about 3 inches in thickness. This wheel smooths the surface of the beveled edges and is ready for the first polishing wheel. The polishing wheels are 34 inches in diameter, 3 inches thick and made of poplar wood. It revolves in a perpendicular position, the attendant pressing the beveled edge against the face of the wheel, adding now and then a quantity of water and powdered pumice stone. This wheel leaves the edges a little cloudy from the pumice stone. To make the edges transparent they are run over another similar shaped felt-covered wheel, the surface of which is covered with rouge.

A number of sheets of glass can be polished at the same time, by laying a number of the sheets on a long cloth-covered table over which, connected to a square horizontal shaft, are a number of iron frames. Inside of these frames polishing blocks are placed, the bottoms of which are covered with felt and rest on the surface of the glass. These blocks are made of wood and filled with lead and weigh about 20 pounds each.

The shaft which moves the blocks over the surface of the glass is set in motion by means of a crank attached to a wheel on the main shafting.

After polishing the glass is taken to the silvering room and washed and silvered as stated above. Some silvering tables are made of hard wood, being about 1½ feet in depth, with a metal top. The interior contains about six inches of water, heated by coils of pipe laid across the bottom. The tables are about 12 feet in length and 7 feet in width. Iron slabs are laid over the top of table and covered with Canton flannel, on which the glass is placed to be silvered. It takes about 2½ hours to dry and then the backs are painted. Some silverers use hartshorn and Rochelle salts in their solutions. The sketches were taken from the plant of A. Vogeley, New York City.



BEVELING AND SILVERING MIRRORS.

Distribution of Cholera.

Though there is little reason to doubt that the distribution of cholera is mainly due to the use of impure water, in certain cases its communication has been traced to various articles of food, and Mrs. G. C. Frankland, in *Nature*, give a summary of recent researches on the subject by Friedrich. More than fifty different articles were specially studied, including fruits, vegetables, milk, tea, coffee, cocoa, beer, wine, caviar, biscuits, bonbons, tobacco, and snuff. In the case of solid substances the cholera bacilli were both rubbed on the outer surface and inoculated on to slices. Under the former condition the vitality of the microbes depended chiefly on the degree of moisture present in their environment, but the acid in the juices of fruit caused their destruction on the slices in from one to six hours. The bacilli survived for several days on cucumbers, cauliflowers, and cabbages, while on spinach leaves kept in a damp atmosphere they were still present after twelve days. A three per cent infusion of black Chinese tea destroyed them within twenty-four hours, and in a four per cent infusion no trace could be found at the end of sixty minutes. In the case of coffee a two hours' immersion in a six per cent infusion sufficed for the destruction of the organisms. Beer of various kinds was equally fatal, one to three hours being the limit; but wines acted best of all, vitality being extinguished within twenty minutes by red wine and within five minutes by white.

The New Rifle for the Navy.

The navy has made a new and radical departure in the manufacture of small bore arms. The recommendation of the Chief of the Ordnance Bureau, founded on the report of the Newport Board, has been approved by Secretary Herbert. The new caliber is 0·234 of an inch. This is the smallest caliber regularly adopted by any government. The caliber of the French Lebel rifle is 0·315; the German Mannlicher is 0·311; the Danish Krag-Jorgensen is 0·315; the English Lee-Speed 0·303; the Swiss Schmidt 0·295, and our new army model 0·30. The board recommends the 0·234 caliber, as they consider that it will give higher velocity, greater range, greater penetration and greater accuracy than the 0·30, with the added advantage of allowing the men to carry a greater supply of ammunition. The disadvantage is the lack of interchangeability of ammunition between the two services. The figures given above for the guns adopted by the foreign nations are the latest. In the last few years the reduction in caliber has been phenomenal. The English Martini and the old Springfield rifles were 0·45, the famous Chassepot of France 0·433, the Russian Berdan 0·42. The number of rifles needed by our navy is small, but the department will, if necessary, furnish the barrels for the manufacturers to apply the breech mechanism.

The nickel alloy has become famous in the manufacture of our armor plate, so that it is, therefore, not surprising to learn that the 0·234 barrels to be furnished to the competing inventors of magazine guns will be made of nickel steel alloy. We shall look for the competitive tests with great interest.

High Speed on the Pennsylvania Railroad.

Engine No. 225 of the Pennsylvania's new class P, with 78 inch wheels, did some fine running a few days ago, having reached the speed of 90 miles per hour, and averaged over 87 miles per hour for several miles. It also ran 65·2 miles (including six slow-ups) in 62·75 minutes, and from a standstill at Bay View it ran to Chases, 11·4 miles, in 9 minutes and 39 seconds.

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RECENTLY PATENTED INVENTIONS.

Engineering.

ELEVATOR AND CONVEYER.—Lewis A. Park, Townsbury, N. J. A centrally pivoted track is adapted to move horizontally on an upright portable open frame, a carriage running on the track past its pivot and through the frame, there being a gear and chain mechanism for moving the carriage and detachable braces for the ends of the track to support it at both ends at right angles to the frame. The invention affords a simple and strong machine for lifting and placing building materials or other heavy articles, the braces strengthening the extended portions, and the machine being in very compact shape to be hauled about.

ELEVATED RAILWAY.—John N. Valley, Jersey City, N. J. An improved traveling carriage or hanger has been designed by this inventor, suitable for suspending any desired form of car, and positively to prevent its derailment. The carriage has four standards, constituting with a bottom band and uniting bars a frame in which are journaled suspension wheels and safety wheels, the treads of the latter being spaced sufficiently below the running wheels to receive the rails between them, he flanges of bo h wheels being on the inside of the track rails. The invention also provides an improved track and support therefor, whereby the strain on the rails is distributed.

CENTRIFUGAL SHAFT GOVERNOR.—George S. Neeley, Pacific, Mo. This invention consis's principally of a pivoted eccentric disk adapted to move across the driving shaft of the engine, and connected with a central gear yieldingly connected with the hub of the governor wheel secured to the driving shaft, weighted and spring-pressed segmental gear wheels being mounted to turn on the governor wheel and in mesh at opposite sides with the central gearwheel. The device is of very simple and durable construction, and very effective and sensitive in operation, to accurately govern the motion of the valve and insure uniform running of the engine.

Mechanical.

SAW COTTON GIN.—Nathan Whalley, Fort Payne, Ala. In this machine a revoluble toothed huller is arranged near the saws and beneath the chute, and fingered or toothed huller bars near the saws and the back portion of the chute, a pair of carding rolls being arranged parallel above the saws, while there is a third carding roll between the pair of rolls and the saws, to clean the larger rolls. Ordinary gin saws are used, and the feed and speed generally be perfectly controlled, but the cotton may be cleaned of foreign matter before it is delivered to he saws, thus obviating danger of fire by friction and damage to the saws. The saws are not necessarily forced deeply into the roll of seed cotton, thus providing against kinking or otherwise injuring the lint.

CENTRIFUGAL MACHINE.—Leon F. Haubtman, New Orleans, La. Within a stationary shell or curb from which a discharge spout delivers to chutes is suspended a revolving basket with perforated sides, and permitting the free circulation of steam, air, or gas, between the basket and curb. Secured to the bottom of the basket is a fan comprising a plate turning above the annular channel in the curb bottom, and a number of curved blades secured to the under side of the plate, the fan blowing lightly to the inner periphery of the curb, and not allowing the escape of water, moisture, or steam, where it would come in contact with the dry sugar discharging from the basket. The machine is especially designed to facilitate the separation of liquids from solids in the sugar manufacture.

WIRE SHEARS.—Louis Townsend, Evansville, Ind. This is a tool for the use of firemen and others who may have to cut electric wires. It has two heads, each having cutting jaws, and pivoted together centrally so that they coincide when in normal position, he shanks and attached handles being curved laterally from each other, so that when the handles are drawn apart the cutters meet. The handles are insulated, and the cutters are so arranged that they may be either pushed or pulled against the wires to be severed.

NUT LOCK.—John D. Fichtner, Uniontown, Pa. The bolt, according to this improvement, is provided with two sets of threads cut in opposite directions, with nuts fitting the threads, the main nut being provided with a chamber and a spring pawl, and the locking nut being fitted to the reverse thread and provided with a ratchet.

LUBRICATOR.—Nathaniel J. H. Duncan, Parkville, Md. A divided grease reservoir adapted to be secured to the connecting rod has tubes leading from its compartments into the box of the crank, reciprocating plungers sliding in the tubes resting upon the crank. The device is of very simple construction and is designed to automatically deliver just the right quantity of oil to the crank, without regard to the speed of the engine or the temperature of the oil.

LOOM.—William Britain, Jr., London, England. This invention relates to looms for producing coir yarn mats and similar fabrics, and provides pile yarn carriers passing between the reed plates of the batten and extending nearly to the fell of the cloth, together with means for causing each carrier to pass alternately on opposite sides of the ground warp which passes between the same reed plates. The loom is designed to produce a high grade fabric in which the tufts of the pile are looped around the ground warps instead of being caught by the weft, as in ordinary pile fabrics.

Agricultural.

CORN HARVESTER.—James E. Perkins, Brownwood, Texas. This is a machine capable of being attached to any farm wagon, so that when the wagon is drawn over the field it will cut the ears from two rows of corn simultaneously and deposit the corn in a receiver at the rear of the cutters. Power is afforded by pinions from the rear axle to operate levers which reciprocate knives with which the ears are brought in engagement by the pressing down of the corn stalks, the ears dropping into chutes from which they pass to the receiving receptacle, to be removed from thence to the ody of the wagon.

FERTILIZER DISTRIBUTOR.—Thomas W. Sample, New Washington, Ind. This is an improvement in devices to be attached to planting machines, to distribute the fertilizer at he time the seed is planted. It is adapted to evenly distribute the fertilizer in front of and behind each hill of corn or sow it in drills if desired. By means of a valve of novel construction the feed of the fertilizer is perfectly controlled, and means are also provided to regulate he speed of the distributor, to make it drop fast or slow.

Miscellaneous.

GAS METER CONNECTION.—Albert H. Gindele, Jersey City, N. J. This is an improvement intended for use as a substitute for the solder joints usually produced between the thimble of a union nut and the end of the lead pipe, and also between a common nipple that is used to join the lead pipe connection to an iron pipe. The lead pipe is radially flanged at the end, and on it is an externally threaded sleeve, while a threaded thimble is screwed into the pipe, and a junction nut threaded in two diameters engages the sleeve and thimble, a union nut connecting the thimble with a meter post.

PHOSPHATE SEPARATOR AND DISINTEGRATOR.—George Guild, Knoxville, Tenn. This invention provides a revoluble receptacle into which extend steam pipes, and in which the phosphatic earth may be agitated and simultaneously subjected to blasts of steam, the filtrate being then strained away from the nodules or pebbles. The apparatus is comparatively inexpensive, and the method is very efficient.

STEAMING APPARATUS.—Henry G. Hall, Blacksburg, S. C. A kettle with its base on a furnace, and circulating pipes extending under the base plate, whereby the water may be readily heated to a temperature of about 275° F., is arranged to accommodate a series of circularly traveling baskets containing filled cans or other articles to be steamed. Each of the baskets is engaged by an arm connected with a flange on a sleeve turning on the upper part of a central flue, and the wheels of the basket carriages travel in the bottom of the kettle, the wheeled baskets being conveniently lifted in or out of the kettle for filling or emptying or moving to and from the packing room.

METHOD OF PRESERVING WOOD.—Francis Hall, Tacoma, Washington. This invention relates more particularly to the treatment of wood for protecting it from the ravages of the teredo, as well as other forms of animal life, also rendering the wood less inflammable. It comprises subjecting the wood to the action of a solution of alkaline hydrates in connection with alkaline carbonates and one or more of the following salts: Alkaline aluminates, alkaline silicates, alkaline chromates, alkaline arsenates or arsenites, alkaline sulphides or alkaline sulphide solution of metallic sulphides, the processes varying with the wood and purposes for which treated.

CONSTRUCTION OF BUILDINGS.—William M. Myers, Hannibal, Mo. The wall, according to this improvement, is composed of brick laid longitudinally, wooden strips disposed between each course of brick and mortar courses between the faces of the strips and the brick, the outer edges of the wood sections being set back from the edges of the brick to form grooves in which the cement filling is placed. The main purpose of the invention is to lessen the cost of construction, reducing the quantity of brick and labor by about one-half as compared with ordinary building.

STORE SERVICE APPARATUS.—James R. Pollock, Mansfield, Ohio. This improvement relates particularly to the means of propelling the basket or car, there being a propelling line connected at one end with the fixed truck, at the other end of the propelling line being a ball or block and a fixed guide to be engaged thereby to take up slack. To send he basket, it is only necessary to pull upon a hand line and lift the ball to he top of the guide, he operating line not only serving to propel the basket, but also as a brake therefor.

CAMP STOVE.—George W. Mings, New Castle, Col. This is a stove which may be so closely folded up as to be carried in a saddle bag, and yet may be quickly set up for effective service. It has rectangular body sections hinged together at their ends and a series of triangular sections hinged at their bases to the upper edges of the body sections and provided with separable connections. The stove, as set up, is triangular in form, with a door in the front body section.

OVERALLS.—Philip J. Lonergan, Denver, Col. This is a garment in which the outer sides of the legs are open from top to bottom, having along their edges separable fastenings, while at the opposite ends of the front section of the waist portion are extended pull pieces, thus forming a garment which may be put on or taken off with great facility.

REFRIGERATOR.—Lansing Bonnell, New York City. The upper ice chamber and lower provision chamber of this refrigerator are connected by detachable flues, the parts being so arranged as to promote a constant circulation of air and an even distribution of the cold air which passes downward from the ice chamber. The ice chamber is covered by a swinging lid which has in the center a depressed condenser. Every flue and air discharge, as well as the trap, may be easily removed or thrown open for inspection and cleaning, so that every part may be readily kept clean and sweet.

SAW FRAME.—George M. Harriman, South Thomaston, Me. This is a frame in which the brace or central part of a buck saw is pivotally connected with the curved end piece of the outer end of the frame, allowing the end piece to tilt freely in straining the saw without weakening the frame.

HALF TONE NEGATIVE FOR PHOTO. PROCESSES.—Frederick J. M. Gerland, Bayonne, N. J. A sensitive plate is, according to this process, subjected a part of the time to a full exposure wi hout a screen, and for the remainder of the time of full exposure with a screen between the negative and object. By this means a negative is made which has a uniform tone in the high lights, producing a clear or non-printing space in the positive print on he stone, zinc or copper plate, so that the finished print shows clear white spaces in the high lights corresponding to the high lights on the object photographed. This work has formerly been done by the artist with tools or acid.

LEDGER INDEX.—Franklin A. Ransom, Farley, Ia. This is a device of simple form, constituting no part of the ledger itself, but arranged for readily posting he desired names and conveniently finding the desired page of any account, and also indicating he proper ledger where several are used. In a casing open at one side and at the top are pivoted L-shaped frames with arms and adapted to hold index leaves, transverse shafts in the casing having arms pivoted to the arms of the frames and with handles at their outer ends for turning hem.

SLEIGH.—Friederich A. Schaefer, Truckee, Cal. This sleigh has drive wheels held vertically adjustable on the sides of its platform, whereby the sleigh may be conveniently propelled and steered over the ice and snow without danger of sinking the wheels too deep into the snow. Besides the main runners, this sleigh has auxiliary runners adapted to be fastened at their ends to the main runners, and near its forward end are fulcrumed rudders connected by a cord with handles in easy reach of the operator. By means of wheels journaled in the front, the front end of the sleigh may be raised off the snow or ice, the wheels being normally folded back out of contact with the snow or ice.

SLED PROPELLER.—A further improvement of the same inventor provides a sleigh adapted to be readily propelled and steered over ice or snow, either by he occupant or by a suitable motor within he sleigh body. On each side of the sleigh box is a shaft carrying a paddle wheel operated by a crank arm by a person in the sleigh, the paddles engaging the snow or ice to propel and steer the sleigh.

BICYCLE.—Samuel A. Donnelly, Chicago, Ill. This wheel has a diamond-shaped frame formed of four metal rods bent to form a double diamond frame and having heir rear ends arranged approximately parallel, there being link-shaped fittings upon the rods in advance of their rear extremities. The vehicle is very light and strong, while the frame is peculiarly adapted for a simplified driving gear in he parts most liable to get loose in bicycles, which are stronger, owing to fewer connections.

CHAIR.—Thomas S. King, Cincinnati, O. The combined folding and swinging chair designed by this inventor is of simple and inexpensive construction, quickly and easily set up and taken down, and when not in use it can be folded and packed in very small space. It has two upright side standards, and the chair frame as well as he uprights are made of flat metal, the frame comprising a seat frame, a back frame and a drop frame pivoted to the opposite ends of the seat frame. The back, seat and drop frames are covered by a single piece of cloth stretched over the sections and wound at opposite ends upon top and bottom crossbars, the cloth being so retained that it is impossible for it to sag in the back or seat.

WASHING MACHINE.—Mary A. Marks, Toledo, O. This machine is designed to facilitate the thorough washing of clothes without boiling, either before or after the washing, and in such manner as will avoid all possible injury to the garments. With this improvement the clothes are not rubbed, but receive first a saturating, then a pressing and then a rinsing to remove the dirt. A lever is pivoted on a standard in the middle of the suds box lid, plungers extending from the lever through apertures in the lid, there being clothing carriers on the lower ends of the plungers, consisting each of an open bottom casing with top apertures.

BRIDGE GATE.—William J. Brown and John K. Walker, Coal City, Ill. Combined with two gates and mechanism for moving them is a swinging brace on the outer end of one gate, while a rack and pinion mechanism is carried by the abutting ends of the two gates for automatically swinging the brace into and out of operative position when the gates are moved toward and from each other. The improvement is adapted to automatically close and open the approaches to drawbridges with the swinging of the bridge, and is a simple, strong and positively working apparatus to operate a fence or gates by the movement of the bridge.

HERNIAL INSTRUMENT.—Alexander Dallas, New York City. This is a very simple implement for use in inguinal and femoral herniæ, consisting of a head and handle, the head flattened and its point smooth and blunted, while its anterior and posterior surfaces and outer edge are covered wi h fine, needle-pointed serrations, the inner edge being smooth and having a deep groove. The handle part has a movable cover, which covers the serrations as he implement is introduced.

EARTHENWARE SEWER PIPE JOINT.—Robert Ewing, 16 Shaftesbury Avenue, London, England. This is an improvement, especially in that class of joint with ordinary faucet, and with external shoulder or flange on the plain or opposite end of the pipe, made of the same material as and integral with the body of the pipe. The joint has ample internal space for the luting or grouting, and affords a double bearing to the spigot or plain end of the pipe, dispensing with the ring or annular rib at the lip of he socket. The joint is closely and evenly fitting, especially at the invert or floor of the tube.

BUGGY TOP FOLDING DEVICE.—Lacrota L. Short, Russellville, Mo. Journaled in the vehicle box is a shaft with upwardly extending arms having a loose connection with the buggy top frame, and downwardly extending arms connected with foot levers, whereby a rocking motion may be imparted to the shaft. The arrangement is such that one sitting on he buggy seat can by pressure of the foot readily open or close the buggy top at any time while the vehicle is in motion. The improvement is readily applicable to all ordinary buggy tops.

DESIGN FOR FABRIC.—William S. Friedlander, Passaic, N. J. The leading feature of this design consists of the representation of a fox skin in an outstretched position. The mat effect is produced by shadowy lines at the marginal portions of the skin, thus producing a relief effect.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

THE TRANSITION CURVE, BY OFFSETS AND BY DEFLECTION ANGLES. By C. L. Crandall, C.E. First edition. New York: John Wiley & Sons. 1893. Pp. v, 64. Price $1.50.

This little handbook is designed for use by the civil engineer in laying out railroads. It refers more particularly to the change from the level straight track to the inclined circular track. This change must naturally be made an easy one in order to prevent disturbances to rolling stock and twisting of the trucks. The point is to make the inclination of the roadbed proportional to the centrifugal force at every point. This statement from the opening paragraph of the book is the keynote to the work, which, with its detailed description of methods and full tables, covers a very interesting field for he civil engineer.

A POPULAR HISTORY OF ASTRONOMY DURING THE NINETEENTH CENTURY. By Agnes M. Clerke. Third edition. London: Adam & Charles Black. 1893. Pp. xv, 573. Price $4.

We have recently had occasion to review Professor Mach's work upon the history of physics. Miss Clerke's production does for modern astronomy what Professor Mach's has done for the kindred sciences. To the present work nothing but praise can be awarded. Its treatment is very thorough, its history is brought down to a recent day, and the chapters on spectroscopy and recent methods of investigation and on the attack of celestial problems are of the greatest interest. The book is very beautifully illustrated and forms an admirable compendium of the work done in our century by astronomers.

SCIENTIFIC AMERICAN BUILDING EDITION.

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2. Plate in colors showing Queen Anne cottage of Mr. George W. Childs, at Wayne, Pa., erected at a cost of $6,700 complete. Perspective view and floor plans. An attractive design. Messrs. F. L. & W. L. Price, architects, Philadelphia.
3. A dwelling erected at Holyoke, Mass. Perspective view and floor plans. A model design. Cost $6,900 complete. Mr. B. P. Alderman, architect, Holyoke, Mass.
4. A suburban cottage erected at New Haven, Conn., at a cost of $2,854 complete. Floor plans, perspective view, etc. Messrs. Wilson & Brown, architects, New Haven, Conn. An excellent design.
5. Engraving and floor plans of an elegant residence erected for W. R. Mygatt, Esq., at Denver, Col., at a cost of $28,000. Messrs. Lang & Pugh, architects, Denver, Col.
6. The beautiful residence of Mr. Walter Dunning, at Denver, Col., erected at a cost of $26,000. Floor plans and perspective elevation. Messrs. Lang & Pugh, architects, Denver, Col.
7. A cottage at Hartford, Conn. Floor plans and perspective elevation. A unique and convenient design.
8. A residence at Carthage, Ill., erected at a total cost of $4,500. Perspective view and floor plans. Mr. G. W. Payne, architect, Carthage, Ill.
9. Residence of Mr. E. W. Smith, at Brazil, Ind., erected at a cost of $3,600 complete. Plans and perspective.
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15. Miscellaneous Contents: Imitation walnut.—Antinonnin.—Protection of adjoining walls.—The Draper recording thermometer, illustrated.—Improved elevators.—An improved woodworking machine, illustrated.—House heating boilers, illustrated.—Slow burning dwellings.—The Pasteur filter, illustrated.—The Willer Mfg. Co.'s exhibit at the World's Fair, illustrated.—Cedar and cypress tank, etc.—A patry-line quarrel.

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Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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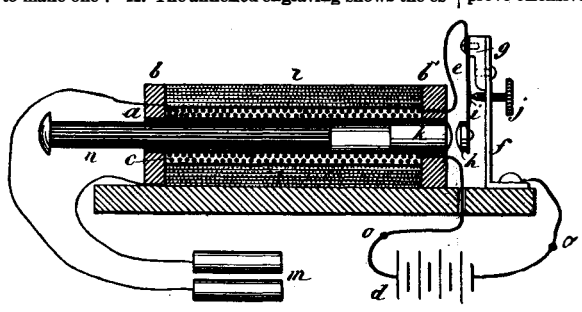
Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(5438) W. M. McV. says: On page 339, "Scientific American Cyclopedia of Receipts," it says to put a small quantity boracic acid in milk to keep it from souring. What quantity per quart would you use, also is it injurious to the health? If not, is it beneficial to the health? A. Two-thirds of drachm of boracic acid to one gallon of milk. If boracic acid is not obtainable, then one and one-sixth drachms of borax to one gallon of milk. Adding one drachm of salt per gallon with the above improves the keeping of milk. This treatment of the milk required to be kept for a few days is not injurious. We do not know that it is beneficial to health.

(5439) J. M. S. and others write: I wish to make a medical induction coil. Will you tell me how to make one? A. The annexed engraving shows the essential features of an ordinary medical coil about one-half actual size, linear. The exact dimensions are immaterial and the direction of the winding of either primary or secondary wire is also immaterial. The spool, *a*, may be made entirely of wood, or of a thin tube of hard rubber with wooden or rubber ends, *b b'*. On the spool is wound the primary coil, *c*, consisting of two layers of No. 20 cotton-covered magnet wire (American wire gauge). The ends of the primary wire pass through the end, *b'*, of the spool. One end is connected with one pole of the battery, *d*, the other end is connected with the fixed end of the spring, *e*, which is supported by the standard, *f*. A block, *g*, of insulating material (hard rubber or wood) is placed between the standard and spring, and is fastened to each by means of a screw. The spring, *e*, is provided at its lower end with a soft iron button, *h*, which serves as an armature. At or near the middle of the free part of the spring is soldered a small plate of platinum, *i*, and in the standard, *f*, is inserted a platinum-pointed contact screw, *j*. The standard, *f*, is connected with the remaining pole of the battery, *d*. In the end of the spool adjoining the armature, *h*, is inserted a short piece, *k*, of well annealed iron rod, which reaches into the spool far enough to be surrounded by several convolutions of the primary wire. The primary coil is wrapped with two or three thicknesses of writing paper, and upon this is wound the secondary coil, *l*, consisting of 10 or 12 layers of No. 36 silk-covered magnet wire. Before beginning the winding of the secondary wire a piece of flexible conducting cord should be inserted in the head of the spool, and the inner end of the fine wire should be attached to it. The outer terminal of the secondary coil should also terminate in a piece of flexible cord. These flexible cords may be connected with binding posts or attached directly to the electrode, *m*. In the coil is inserted a bundle, *n*, of soft iron wires (Nos. 20 to 24). These wires may be fastened together by a wrapping of firm, stout thread, varnished, or it may consist of tinned iron wires, which may be soldered together. A brass-headed nail may be inserted in the bundle in lieu of a part of the central wire, to form a finish for the end of the bundle. Two cells of Leclanche or dry battery in series will run the coil, or a single small cell of plunging bichromate battery may be used. This coil may be mounted as elaborately as the maker may desire, or it may be made plain, as shown in the engraving. If it is desired to make use of the extra current of the primary coil, flexible cords with handles may be connected at *o o'*. The strength of the induced current is varied by moving the core, *n*, in or out. As the action of this coil is like most of those now in use, it is unnecessary to describe it.



(5440) B. V. C. says: I am building a 27 foot launch, 5 foot 6 inch beam, draws about 21 inches water loaded, and would ask what size engine furnished with 200 pounds steam would be suitable for boat to make at least 10 miles per hour, and would a compound engine be best, and what size 3-bladed wheel should I use? A. Engine cylinder should be 4½ inches diameter, 5 inches stroke, making 350 revolutions per minute. The boat should have the keel drop at stern to take a 24-inch 3-blade wheel, 3½ feet pitch. We do not recommend a compound engine for your boat. Complication and outboard condenser more than compensate for the gain in fuel and size of boiler.

(5441) P. P. K. asks: 1. Of what is Portland cement made, and how is it made? A. We refer you to our SUPPLEMENT, Nos. 231, 386, 620, and 752, for excellent papers on the subject. 2. I have a Daniell battery that works well, but the zinc is eating away too fast. I use common salt in the clay cup. What shall I do to remedy it? The battery is worked on an open circuit. A. Paraffin the lower half of the cup. It must be perfectly dry, and the paraffin must be melted in by heat. The battery is not suited to open circuit work.

(5442) A. W. says: I have a steamboat 22 feet long on water line, 4 feet 8 inches beam, 16 inches in water, including 4 inches keel, and of good model, propelled by a 1 horse power Shipman engine, 400 revolutions at 100 pounds steam. Please inform me in Notes and Queries what size and pitch of screw I should use to get the best speed? A. A 14 inch wheel is the proper size for your boat, pitch 26 inches. The one horse power Shipman engine is rather small for the boat and its proper size wheel. You will probably obtain no more than 300 revolutions per minute, with possibly 6 miles per hour.

(5443) C. A. B., of Virginia, asks: What is the simplest remedy to keep ticks off one's person? When I spend my summer in the country, I cannot take a walk without returning almost covered with these little pests. Is there anything than can be applied to the clothing which will make it offensive to them? A. Reply by Professor Riley.—It is doubtful whether our correspondent really means ticks or mites. The true ticks are of a considerable size and do very little harm to human beings. The mites or "red bugs" or "jiggers," as they are called in different parts of the South, are in reality the larval forms of the true harvest mites. The false genus Leptus was formerly based upon these larval mites and I have described two species, *Leptus irritans* and *L. Americanus*, both found in the Southern States. I judge that the correspondent refers to these so-called "red bugs," which are very abundant in the South upon the grasses and low-growing vegetation in the country and the cause of great annoyance during the summer months. There is, unfortunately, no substance which may be applied to the skin or to the clothing which will prove offensive and deterrent to the mites and which will not at the same time be offensive to the human olfactory organs. Oil of tar, for instance, a not very sweet-smelling material, if applied here and there to the clothing or rubbed on the skin, will keep off the mites. It is very heating to the skin, however, and is disagreeable on that account. In localities where these insects are particularly abundant we have anointed the skin with kerosene, which also acts as a deterrent, but this is not agreeable for reasons which will be readily understood, and, therefore, cannot be recommended as a satisfactory practice, so that, after all, the best thing which can be done is to change one's clothing after coming in from a walk and perhaps jump into the bath.

(5444) C. F. K. asks: How much air is needed to burn one pound of coal in one second? A. One hundred and fifty cubic feet of air, varying slightly with the carbon and hydrogen element in the coal, for the combustion of 1 pound of coal, without reference to time. 2. How would you calculate the size and weight of a fly wheel on a certain horse power engine? A. The size and weight of fly wheels varies very much with the kind of engine and work to be done. The diameter varies in practice from three to five times the stroke of engine. A single engine requires a larger and heavier fly wheel than a double engine. Approximately for engines of the Corliss type 80 pounds to the indicated horse power, for 100 horse power and under, dropping to 60 and 50 pounds per indicated horse power up to 1,000 horse power.

(5445) A. W. G. writes: 1. In making the pipe coil boiler mentioned in SUPPLEMENT, No. 702, could I not connect the valve C with a tank placed at a level with valve, and in that way receive a steady feed? A. A tank may be used in place of feeding by the funnel, but a constant or open feed cannot be used in this way or by gravity, as in this case the steam pressure would blow back and with no pressure the boiler would fill solid. A check valve would prevent blowing out, but would not prevent filling too full. With the arrangement as illustrated in No. 702, the filling should be done under supervision and stopped at the proper height of the water in the boiler. 2. Instead of the armature core, for the motor described in SUPPLEMENT, No. 641, being made of wire, could I not use sheet iron blanks, 3 inches diameter, making the core 2 inches thick, adopting Siemens winding, using 3 pounds of wire? A. Yes, sheet iron disks may be used as stated. 3. Also, how many storage battery cells would it take to run above motor? A. Two to four storage battery cells will run the motor, according to the power to be developed.

(5446) A. J. H. asks: 1. I have an 8 light 16 candle power dynamo, I built from drawings of SUPPLEMENT, No. 600, and is shunt wound, and find it works very well, and lights the 8 lamps. Now I have a foot lathe and desire to run the same by a motor, and wish to know if I can change the above machine so that it will work with such a battery as described in "Experimental Science," page 401, figure 394, 8 cell plunge, as recommended for running motor. such as described in the above work. I wish if possible to get power enough out of my dynamo to run the lathe, as I have no use for it as a light machine. A. Connect the magnet windings in parallel so as to get low resistance. Keep it shunt wound. The battery will not run it very long. 2. It says that the above named battery has the disadvantage of running down or becoming exhausted in a few hours. I should feel obliged if you would tell me what gives out about it, if it is the zinc or carbon, or does the bichromate solution become exhausted? A. The solution becomes exhausted. 3. Could you inform me where I could obtain the carbon and zinc plates for such a battery, and about what would be the cost of a set for such a battery, and how long they would last by using the battery one or two hours a day? A. Address some of our advertisers who deal in electrical goods. The zincs will last a good while—the carbons indefinitely. It will not be cheap power. 4. Will the dynamo I have, by cutting out half the wire on fields and armature, work as a motor with half the power it would take if all the wire was in connection? A. No. 5. Could you tell me where I could get castings for a half or 1 horse power petroleum or gasoline engine, or if I might be successful in making one myself, being a mechanic and having worked on steam engines for some time? What I would like to learn is, how does the oil go into the cylinder, and what would be the proportion of oil and air for a single charge for a 1 horse power engine? I have thought of constructing one if I cannot get the necessary power from my dynamo. A. For gas engine we refer you to Robinson's "Gas and Petroleum Engines," $5.50 by mail.

(5447) S. G. M. writes: There is in the head of my bedstead one of those bugs that keeps up at times a continuous, very annoying knocking and ticking. I have tried to locate him and then to destroy him, but never succeeded as to the former. Could you tell how to find out his location, and if it would be possible to destroy him in the wood? A. Reply by Professor C. V. Riley.—The insect complained of by your correspondent is either one of the Ptinid beetles (the so-called "death watch") or, what is more probable, the larva of a longicorn beetle. Such insects are known to live for years in the dry wood of furniture before they emerge or die. It is of course a very difficult matter to locate exactly the insect working in the wood. In some instances the presence of little piles of sawdust lying beneath the place where the insect works will help to locate the enemy. If the latter does not eject any sawdust, it has sometimes been located by moving a lighted candle along and close to the suspected parts of the wood. The proximity of the light will cause the larva to "knock" and it can then be cut out with a knife. If the burrows of the insect are close to the surface of the wood, they can be detected by taking soundings with a stout steel needle, and if the burrows are found, the killing of the larva is easily accomplished by boring a small hole in the gallery and injecting therein a sufficient amount of bisulphide of carbon by means of a small syringe.

TO INVENTORS.

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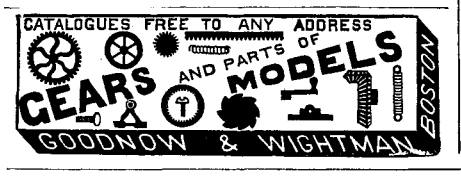

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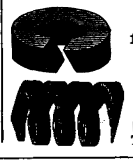
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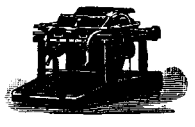
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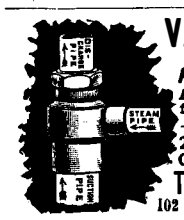
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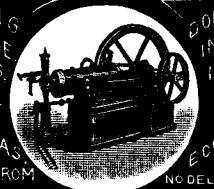
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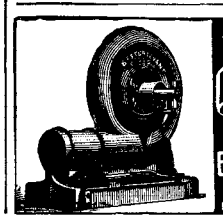
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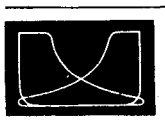
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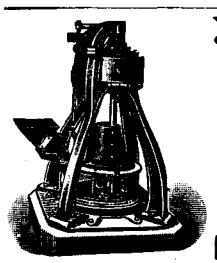
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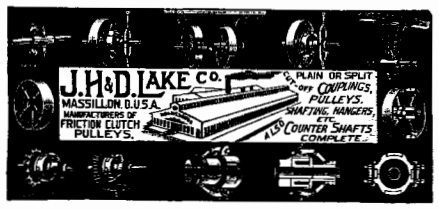

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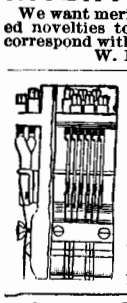

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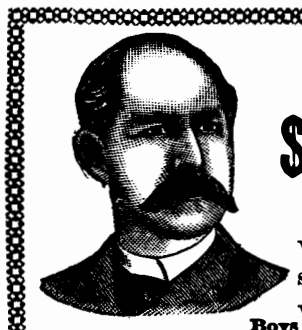

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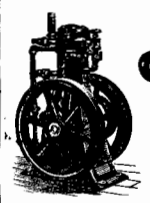

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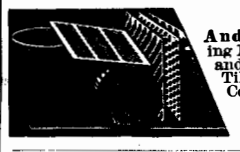

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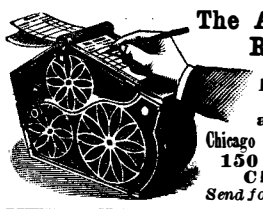

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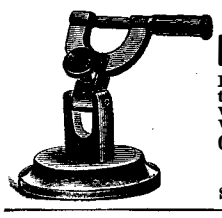

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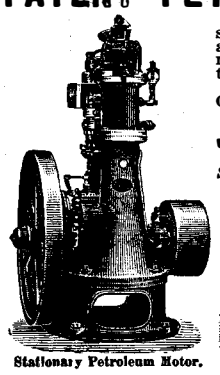

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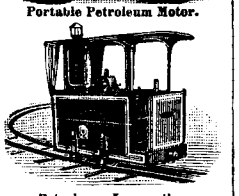

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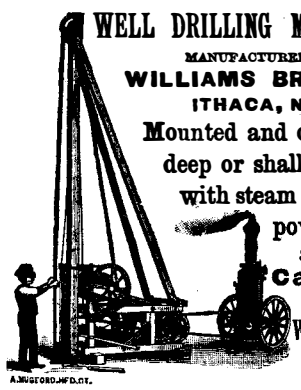

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